

NAVAL EXCHANGE SERVICE
STATION
REMEDIAL INVESTIGATION
FINAL TECHNICAL REPORT

NAVAL AIR STATION
Brunswick, Maine

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

SECTION 1.0 INTRODUCTION

1.1	PURPOSE AND SCOPE	1
1.2	SITE DESCRIPTION AND BACKGROUND	1
1.3	HISTORY OF USTS AT THE SITE	2
1.4	HISTORY OF ENVIRONMENTAL ACTIVITY AT THE SITE	3

SECTION 2.0 FIELD INVESTIGATION METHODS

2.1	SOIL GAS SURVEY	5
2.2	INSTALLATION OF MONITORING WELLS AND SOIL SAMPLING	6
2.3	WATER LEVEL GAUGING AND GROUNDWATER SAMPLING	8
2.4	PERMEABILITY TESTING	9

SECTION 3.0 DETERMINATION OF SOIL AND GROUNDWATER CLEANUP REQUIREMENTS

3.1	CLEANUP STANDARDS AND GUIDELINES	11
3.2	POTENTIAL RECEPTORS	13

SECTION 4.0 RESULTS AND INTERPRETATION

4.1	SITE GEOLOGY	15
4.2	SITE HYDROGEOLOGY	15
4.3	SOIL GAS SURVEY	16
4.4	ANALYTICAL QUALITY ASSURANCE	17
4.5	SOIL SAMPLING RESULTS	18
4.6	GROUNDWATER SAMPLING RESULTS	19
4.7	SUMMARY AND INTERPRETATION OF RESULTS	20

SECTION 5.0 REMEDIAL MEASURES EVALUATION

5.1	REMEDIAL ALTERNATIVES FOR SOIL	22
5.1.1	EXCAVATION AND OFF-SITE DISPOSAL	22
5.1.2	SOIL VAPOR EXTRACTIONS	22
5.1.3	BIOREMEDIATION TREATMENT	23
5.1.4	ASPHALT BATCHING	24
5.2	COST COMPARISON OF SOIL REMEDIATION ALTERNATIVES	25

TABLE OF CONTENTS (CONTINUED)

5.3	REMEDIAL ALTERNATIVES FOR GROUNDWATER	25
5.3.1	AIR SPARGING	25
5.3.2	PUMP AND TREAT SYSTEMS	26
5.4	COST COMPARISON FOR GROUNDWATER REMEDIATION ALTERNATIVES	27
5.5	SUMMARY OF REMEDIAL ALTERNATIVES EVALUATION	28

SECTION 6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1	CONCLUSIONS	29
6.2	RECOMMENDATIONS	30

REFERENCES

LIST OF TABLES

Table 1 - Groundwater Elevation Survey Data
Table 2 - Soil Gas Survey Results
Table 3 - Sample Analysis Summary
Table 4 - Soil Analytical Results
Table 5 - Groundwater Analytical Results
Table 6 - Groundwater Field Parameters

LIST OF FIGURES

Figure 1 - Site Location Map
Figure 2 - Site Features Map
Figure 3 - Soil Gas Survey - Sampling Locations and Results
Figure 4 - Groundwater Elevation Contour Map - May Gauging Event
Figure 5 - Groundwater Elevation Contour Map - June Gauging Event
Figure 6 - Summary of Contaminants Detected in Groundwater Monitoring Wells

LIST OF APPENDICES

Appendix A - Soil Boring Logs and Well Installation Diagrams
Appendix B - Analytical Quality Assurance Report
Appendix C - Permeability/Slug Test Data
Appendix D - Soil Gas Survey Field Data Sheets
Appendix E - Laboratory Field Reports

EXECUTIVE SUMMARY

The objective of this project was to carry out the Plan of Action (POA) for a Remedial Investigation at the Naval Exchange (NEX) service station, Brunswick Naval Air Station (NAS), Brunswick, Maine. The purpose of the investigation was to provide an initial identification of the nature and extent of potential contamination, to identify if a remedial action is warranted, and if so, identify cleanup criteria and a range of potential remedial alternatives which could be implemented during the remedial action.

The NEX service station located at the BNAS maintained three 10,000-gallon underground storage tanks (USTs) and a distribution system (feed lines and pumps) for the retail sale of gasoline. Release(s) of gasoline from this system occurred in the 1980s. The tanks and associated piping are currently inactive and remain in place.

The field investigation included a soil gas survey, installation of soil borings and groundwater monitoring wells, geologic and hydrogeologic characterization of the site, and sampling and analysis of soil and groundwater. Five groundwater monitoring wells were installed on site and sampling of soil and groundwater was performed.

Soil gas measurements indicated elevated concentrations of VOCs adjacent, and downgradient of, the USTs. Chemical analyses of both soil and groundwater indicate the highest concentrations of contaminants were detected at monitoring well MW-4 located on the east side of the NEX service station. Correlation of the existing analytical data with results of the soil gas survey and the reported history of environmental activity at the site suggest that the source of soil and groundwater contamination was a release of gasoline from the UST system located at the NEX service station.

The existing data suggests that soil contamination may be restricted to the NEX service station in the area located immediately to the south/southwest of the three 10,000 gallon gasoline USTs and adjacent to subsurface piping connecting the USTs to the pump island. The lateral and vertical extent of soil contamination remains undefined. Soil contamination represents a potential continued source of release to groundwater.

Groundwater contamination in excess of state and federal guidelines has been detected at, and to the south of, the NEX service station. Gasoline

and fuel oil were identified in groundwater at levels in excess of state guidelines extending to the west and south of the Family Service Center (Building 27). The extent of groundwater contamination currently remains undefined.

Based on application of the Maine DEP's Decision Tree For Setting Cleanup Standards At Petroleum Contaminated Sites, soil and groundwater contamination in the vicinity of the NEX requires remediation. The Decision Tree contains cleanup guidelines suggesting remediation of contaminated soil to 10mg/kg total fuel oil or 5 mg/kg total gasoline and groundwater remediation to 50 ug/l total hydrocarbons, 50 ug/l MTBE, or 5 ug/l benzene. The Maine DEP needs to be consulted to establish cleanup criteria.

Selection of the most cost-effective remedial alternative must be based on specific data defining the areas and volume of soil and groundwater contamination requiring remediation. The extent of contamination in both soil and groundwater that exceeds cleanup criteria is currently undefined. Therefore, identification of the most cost-effective remedial alternative cannot be made at this time.

Additional sampling and analysis of soil and groundwater should be performed to determine the extent of contamination and the areas and volumes of contaminated soil and groundwater requiring remediation. Remedial alternatives presented in this report should be evaluated based on the site and media-specific cleanup criteria established in coordination with the Maine DEP and the volume of contaminated soil and groundwater determined to require remediation. The selected remedial alternative(s) should be presented to the Maine DEP for approval.

1.0

INTRODUCTION

1.1

PURPOSE AND SCOPE

This project was completed as Project No. 5 under NAVFAC Contract No. N62472-91-D-1405. The objective of this project was to carry out the Plan of Action (POA) for a Remedial Investigation at the Naval Exchange (NEX) service station, Brunswick Naval Air Station (NAS), Brunswick, Maine. The purpose of the investigation was to provide an initial identification of the nature and extent of potential contamination, to identify if a remedial action is warranted, and if so, identify cleanup criteria and a range of potential remedial alternatives which could be implemented during the remedial action.

The field investigation for the POA was completed in accordance with 38 M.R.S.A. Ch. 691, and include the following primary elements:

- Performance of a Soil Gas Survey
- Installation of Soil Borings and Groundwater Monitoring Wells
- Sampling and Analysis of Soil and Groundwater
- Aquifer Permeability Testing

The remainder of Section 1.0 provides a description, background, and history of the site. Methods used in the implementation of the field investigation are discussed in Section 2.0. Identification of potential cleanup requirements for soil and groundwater are presented in Section 3.0. The results and interpretations of physical and chemical data are discussed in Section 4.0. An evaluation of potential remedial measures is presented in Section 5.0. Conclusions and recommendations are presented in Section 6.0.

1.2

SITE DESCRIPTION AND BACKGROUND

Brunswick NAS is located in the town of Brunswick, Maine, approximately 27 miles north of Portland, Maine (Figure 1). The NEX service station is located on the base and maintained three 10,000-gallon underground storage tanks (USTs) and a distribution system (feed lines and pumps) for the retail sale of gasoline. Release(s) of gasoline from this system occurred in the 1980s. The tanks and associated piping are currently inactive and remain in place.

The NEX service station is located at the intersection of Second Street and Burbank Avenue (Figure 2). The site is defined as an approximately one acre area, consisting of the NEX service station (Building 538) including two pump islands, the paved parking areas surrounding the service station, and a grassy area to the east of the service station where the three 10,000-gallon underground gasoline tanks are located.

The service station building is approximately 5,300 square feet in area and includes a service garage with two bays, an office, and a small store with a beverage container redemption center. The original building was constructed in 1957. Several additions to the original building have expanded the structure to the east.

The following facilities (which are not displayed on Figure 2) are located adjacent to the NEX service station. Building 295 (a water pump house) abuts the service station on the northern side of the site. Building 11 (the Navy Exchange Complex) is located to the east, approximately 100 feet from the USTs. Building 27 (the Family Service Center) is located approximately 100 feet to the south of the service station on the opposite side of Burbank Avenue (Figure 2). The public works vehicle compound is located to the west of the service station along Second Street.

The topography of the site is relatively flat and slopes gently to the south across Burbank Avenue towards Building 27 (the Family Services Center). The site area is occupied by buildings, paved sidewalks, roadways, parking lots, and grass covered lawn areas.

Buried utilities at the site include a storm sewer pipe and a sanitary sewer pipe; both of which exit the south side of the service station and pass under Burbank Avenue. There are two catchment basins on the site which feed the storm sewer; one located next to the sanitary sewer manhole and the other located just outside the service bays (Figure 2).

1.3

HISTORY OF USTs AT THE SITE

According to an April 4, 1990 listing of all USTs at Brunswick NAS, there are currently four USTs at the NEX service station. These include three 10,000-gallon single walled-steel gasoline tanks located in the grassy area to the east of the service station, and one 1,000-gallon steel fuel oil tank located on the north side of the service station (Figure 2). The three 10,000 gallon gasoline tanks were installed in 1974 and passed an integrity test conducted by Tankpro of Scarborough, Maine, in July of 1989. The 1,000 gallon fuel oil tank was installed in 1975. There is no available documentation concerning integrity testing for this tank. Maine

Department of Environmental Protection (DEP) registration numbers for these four tanks are 14682-1, 14682-2, 14682-3, and 10045-63, respectively.

Three former USTs had been removed from the site including two 5,000-gallon gasoline tanks (removed in 1974 prior to building expansion) and one 550-gallon waste oil tank (removed in November of 1989). The two former 5,000-gallon tanks were located under the current east side of the service station. They were removed to permit expansion of the service station. The waste oil tank was located on the west side of the service station. No records documenting the removal of these tanks were identified in the NAS or the DEP files.

1.4

HISTORY OF ENVIRONMENTAL ACTIVITY AT THE SITE

According to NAS personnel, gasoline odors were detected in the vicinity of the service station in 1981. To determine the source of the vapors, surface soils in a 60 to 70 square foot area around the UST system were removed, and a faulty connection in one of the pipes was found and repaired. The excavated soils were analyzed by DEP personnel, and the contaminated soils were disposed of off-site. No other information was available regarding the removal and disposal of contaminated soils.

According to Mr. Neil Campbell, a NAS maintenance worker, a groundwater recovery system was installed at the site in 1984 to correct for gasoline odors in Buildings 25 and 27. The system is comprised of three wells connected to a central manifold and pump system and is located in the grassy island at the corner of Second Street and Burbank Avenue (Figure 2).

Using this recovery system, groundwater was pumped into a temporary above ground holding tank for approximately one week and analyzed by DEP. Subsequently, for a period of approximately one year, DEP authorized discharge of the groundwater to the nearby storm sewer. Groundwater pumping was terminated when the water no longer appeared to be contaminated. The date of termination of pumping is unknown. No other information was identified regarding the operation and maintenance of the groundwater recovery system.

There are no records, remedial system specifications, or sampling data in DEP's files to document any of the above activities or to characterize soil and groundwater contamination on site. The only documentation in NAS files concerning these activities is a work authorization for installation of the wells dated July 22, 1981.

During a site visit, ERM observed an air exhaust stack that had been installed on the north side of Building 27 (the Family Services Center). According to NAS personnel, this exhaust stack is a passive vapor collection system that is connected to the existing building underdrain system. The exhaust stack was installed in early 1989 to collect and exhaust gasoline vapors that had been detected inside Building 27. The underdrains are part of the building foundation and vary in elevation from 61.0 to 56.5 feet. The underdrain system discharges to the storm water system on the east and west sides of the building. Gasoline odors were detected in 1989 in the storm drain manhole that is the west discharge point of the Building 27 underdrain system.

ERM reviewed Maine DEP files to identify reported spill incidents associated with the site (complete files were only available for the period since 1984). One incident of a gasoline spill at the site had been reported to DEP in 1989. According to Mr. Brad Hahn of DEP's Portland office who prepared a report for the incident, a minor amount of contaminated soil was discovered while performing a tank tightness test. Approximately one cubic yard of soil was removed and disposed of off-site. According to the contractor who performed the tightness test (Tankpro of Scarborough, Maine), the spill did not appear to be related to the tightness test. Based on the contractor's description of the incident, Mr. Hahn indicated that due to the minor nature of the release and immediate containment of the contaminated soil, no follow-up investigation was necessary. No other information was identified in ME DEP files regarding this spill incident.

ERM was issued a delivery order by Northern Division, Naval Facilities Engineering Command (under Contract No. N62472-89-D-1448) to prepare a Plan of Action (POA) and, under the current contract, to investigate the nature and extent of potential soil and groundwater contamination at the NEX service station. Based on these results, identification of remediation criteria and remedial alternatives, would be conducted should a remedial action be required.

2.0

FIELD INVESTIGATION METHODS

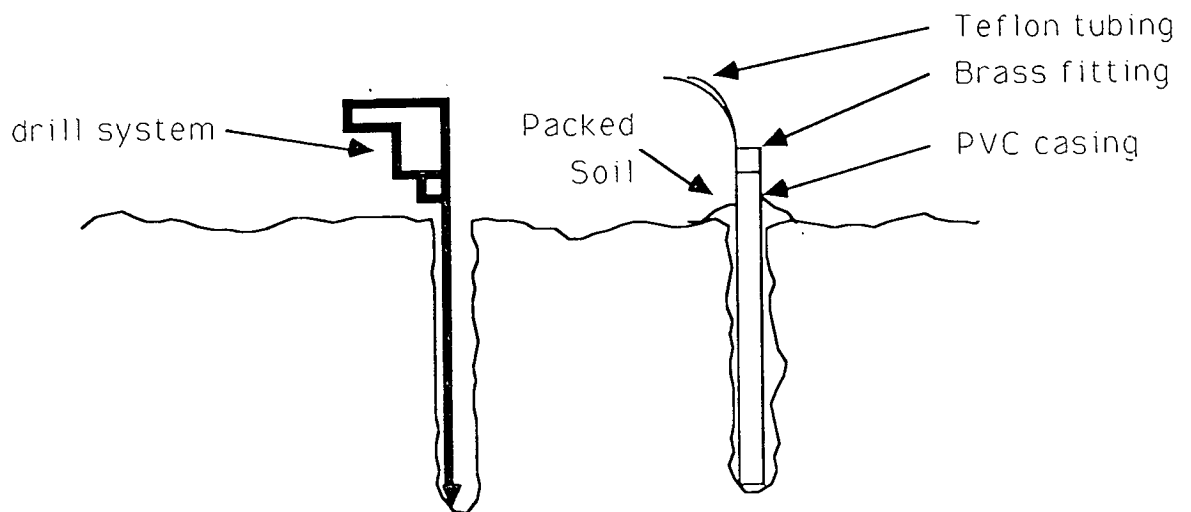
2.1

SOIL GAS SURVEY

ERM conducted a soil gas survey on the site and adjacent areas on May 5th and 6th, 1992. This survey was performed to provide a rapid and cost-effective definition of the horizontal extent of gasoline vapors in shallow subsurface soil. The survey consisted of 55 sample locations which are shown on Figure 3. The locations were selected to meet the following goals.

- To provide extensive geographic coverage of the site.
- To document soil gas conditions in the assumed down gradient direction (south);
- To characterize specific areas of concern, such as the piping associated with the USTs.
- To provide data that may be used in refining proposed locations for monitoring well installation.

Soil gas measurements were collected as follows: a Black and Decker Macho II Rotary Hammer with a nominal one-inch diameter, three-foot long, carbide screw bit was used to advance a small boring at each sample location. Nominal one-inch diameter, four-foot long, open-ended, PVC casing with perforations along the bottom foot were then inserted into the boring. The PVC casing was fitted with a brass opening-reduction fitting on the above-ground end. Teflon tubing was attached to this end and acts as the sampling port for a photo-ionization detector (PID). A diagram of the equipment is shown below.



ERM used a Photo-Vac Tip® PID that was calibrated using an isobutylene gas and a response factor provided by the manufacturer to make the PID provide readings relative to benzene. Once calibrated, the PID was used to record total concentrations of Volatile Organic Compounds (VOCs) relative to benzene in soil gas. Henceforth in this report, total VOCs refers to total VOCs relative to benzene. Both peak and stable readings were recorded at each sampling location. After each measurement, the PVC was removed and the small hole was backfilled with soil from the boring. The PVC casings were decontaminated with methanol and deionized water prior to use in each borehole. Following decontamination, each casing was then screened with the PID to confirm a zero reading before reuse. Results of the soil gas survey are presented in Section 4.3.

2.2

INSTALLATION OF MONITORING WELLS AND SOIL SAMPLING

ERM installed five groundwater monitoring wells to characterize the subsurface geologic and hydrogeologic characteristics of the site and to obtain information on the horizontal and vertical extent of soil and groundwater contamination. All monitoring wells were installed at the locations proposed in the POA, with the exception of MW-4 which was relocated to the area exhibiting the highest soil gas readings. Well locations are indicated in Figure 2. Rationale for the installation of each monitoring well is provide below.

- *Monitoring Well MW-1*

Monitoring Well MW-1 is located northeast of the NEX building in the assumed upgradient direction from the location of the suspected gasoline release. MW-1 was installed to provide

information on background water quality and aide in determining the direction of groundwater flow.

- *Monitoring Well MW-2*

Monitoring Well MW-2 is located downgradient of the USTs to the north of the Family Service Center where gasoline fumes were previously detected. This well was intended to indicate whether gasoline contaminated groundwater is currently migrating towards the Family Services Center from the NEX.

- *Monitoring Well MW-3*

Monitoring Well MW-3 was located downgradient of the former UST location to provide information on groundwater quality to the west of the Family Service Center.

- *Monitoring Well MW-4*

Monitoring Well MW-4 is located in the area of highest soil gas readings. Based on the results of the soil gas survey MW-4 is located just south, and downgradient of, the USTs and associated piping.

- *Monitoring Well MW-5*

Monitoring Well MW-5 is located downgradient of the NEX service station and south of the Family Service Center. This well location was selected to investigate groundwater quality downgradient of the Family Service Center.

Drilling was conducted using hollow stem auger techniques and 10 inch outer diameter augers. Wells were constructed with four-inch inside diameter schedule 40 PVC. A ten foot section of well screen (0.010 inch slot width) was installed in each well such that approximately three feet of screen was located above the apparent level of the water table. All wells were completed with flush mounted protective road boxes.

Drilling equipment was decontaminated between borings by steam cleaning with water obtained from a base fire hydrant located on Burbank Avenue. This water was sampled to document the presence of any contaminants in the water used for decontamination (refer to results in Tables 3 and 4).

ERM collected soil samples from each of the borings to enable physical and chemical characterization of subsurface materials. Soil samples were

characterized by an ERM geologist and recorded on the drilling logs for each well boring along with sample screening results, blow counts, and sample recovery. All split spoon samples were screened for total VOCs using a PID. Screening was conducted upon retrieval of the sample, and again from the sample jar headspace. These values are represented as the first and second entries on the drill logs, respectively. Drilling logs and well installation diagrams are included in Appendix A. The geology of the site is summarized in Section 4.1.

One soil sample from each well which exhibited the highest total VOCs from headspace screening was submitted to Coast to Coast Analytical Services, Inc. in Westbrook, Maine for laboratory analysis. If elevated concentrations of VOCs were not detected in the screening of any of the soil samples from a boring, the deepest sample above the water table was submitted for laboratory analysis. Soil samples were analyzed for the following parameters.

- Benzene, toluene, ethylbenzene and xylenes (BTEX) including methyl tert-butyl ether (MTBE) by EPA Method 8020
- Total lead by EPA Method 3510/6010
- Gasoline by Maine DEP Method 4.2.3
- Fuel oil by Maine DEP Method 4.1.2
- Total petroleum hydrocarbons (TPH) by infrared absorbance - EPA Method 9071

Analytical method summaries and references are included as Appendix B.

One equipment blank was collected and analyzed by EPA method 602 as a quality assurance/quality control sample to provide a check on decontamination procedures. This sample was collected by pouring deionized water into a decontaminated split spoon and sampling that water.

All samples were collected in laboratory prepared jars, placed on ice, and transferred to the laboratory under a chain of custody. Results of soil analyses are summarized in Section 4.5.

2.3

WATER LEVEL GAUGING AND GROUNDWATER SAMPLING

On May 21, 1992, ERM gauged and sampled the five newly installed wells. A second round of water level gauging was conducted on June 23, 1992. Water levels in the wells were gauged to a precision of 0.01 feet

using a Keck Instruments electronic water level indicator. Each well was purged until either a minimum of three volumes of well water were removed or until the well went dry. Groundwater samples were collected from each well and submitted to Coast to Coast Analytical Services, Inc. for analysis by the following parameters.

- Benzene, toluene, ethylbenzene and xylenes (BTEX) including methyl tert-butyl ether (MTBE) by EPA Method 602
- Dissolved lead by EPA Method 7421
- Gasoline by Maine DEP Methods 4.2.1
- Fuel Oil by Maine DEP Methods 4.1.1
- Total petroleum hydrocarbons (TPH) by IR - EPA Method 418.1

Analytical method summaries and references are included as Appendix B.

All samples were collected in accordance with DEP and U.S. Environmental Protection Agency (EPA) Standard Operating Procedures (SOPs). Groundwater samples were preserved on ice and transferred under a chain of custody to Coast to Coast Analytical Services, Inc. Results of groundwater analyses are summarized in Section 4.6.

The pH and conductivity of groundwater from each well was measured in the field using a Myron L pH/conductivity meter. These results are summarized in Table 6.

2.4

PERMEABILITY TESTING

ERM conducted permeability testing in two groundwater monitoring wells to investigate the hydraulic conductivity at two locations on site. MW-4 was selected to investigate the hydraulic conductivity of an upper unit of silty sand. MW-5 was tested to investigate the hydraulic conductivity of the underlying clay unit. Section 3.1 describes the subsurface geology at the site in further detail.

Permeability testing was conducted using falling and rising (variable) head techniques. Since the screen in each of the wells tested straddles the water table, hydraulic conductivities were calculated using data derived from the rising head tests. Falling head test data were collected to check field equipment and procedures. However, falling head test data was not used in the calculation of formation specific hydraulic conductivities.

Permeability testing was performed as follows. A solid, PVC slug was used to displace water within each well. Subsequent recovery (falling head) to static water level was monitored with a Hermit computerized data logger and transducer system. After recovery, the slug was removed, lowering the level of water in the well, and the recovery (rising head) to the static level was again monitored. Water level readings were taken to a precision of 0.01 feet on a logarithmic time scale. An arbitrary reference elevation of 0.00 feet was selected to represent the initial static water level elevation at the beginning of each test. The data was analyzed using the Bouwer & Rice method to determine the permeability at each well. Results are summarized in Section 4.2. Permeability data is tabulated in Appendix C.

3.0 DETERMINATION OF SOIL AND GROUNDWATER CLEANUP REQUIREMENTS

3.1 CLEANUP STANDARDS AND GUIDELINES

There are several potentially applicable cleanup requirements or guidelines including Maine Maximum Exposure Guidelines (MEGs) for private drinking water supplies (10-144A CMR 233), Federal Maximum Contaminant Levels (MCLs) for drinking water, and the Maine Department of Environmental Protection (DEP) Decision Tree for Setting Cleanup Standards for Petroleum-Contaminated Sites (March, 1992).

MEGs and MCLs, listed below in Table 3-1, are not directly applicable because the groundwater at the NEX is not used as drinking water. However, the NEX is in an area that is mapped by the Maine Geological Survey as a Sand and Gravel Aquifer. Therefore, there is a potential (although unlikely) for future use of groundwater at the NAS as a drinking water supply.

TABLE 3-1 DRINKING WATER STANDARDS/GUIDELINES

Compound	MEC (ug/l)	MCL (ug/l)	MCL Status
Benzene	5	5	Final
Ethyl Benzene	700	700	Proposed
Fuel Oil	50	---	not listed
Gasoline	50	---	not listed
MTBE	50	---	not listed
Toluene	2,000	2,000	Proposed
Xylenes	600	10,000	Proposed
Dissolved Lead	20	50	Final

The Decision Tree was developed for use by Maine DEP personnel to determine the level of cleanup required for petroleum hydrocarbon releases. According to Bradford D. Hahn, Maine DEP, The Decision Tree applies to all petroleum hydrocarbon contaminated sites (underground storage tanks, surface spills, etc.) The Decision Tree indicates that the DEP investigator always has the option to set more strict cleanup standards if appropriate for the site, and that less strict cleanup standards should not be used until appropriate hydrogeologic review and/or investigation has been completed. Based on the application of the Decision Tree, the NEX site falls under the "Stringent Cleanup Goals". Stringent Cleanup Goals involve the following criteria:

- 1) Remove all free product.
- 2) remove or remediate contaminated soil containing greater than 10 mg/kg total fuel oil or 5 mg/kg total gasoline as determined by DEP-approved analytical techniques.
- 3) Remediate groundwater containing greater than 50 ug/l total hydrocarbons (gasoline, fuel oil, or kerosene by DEP-approved techniques), 50 ug/l MTBE or 5 ug/l benzene as determined by DEP or EPA-approved techniques.

Please note that these cleanup goals for soil are based on wet weight, whereas analytical methods used for the data presented in Table 5 are based on dry weight as per accepted laboratory practice.

The groundwater cleanup goals specified in the Decision Tree are equivalent to the MEGs and MCLs listed for the same compounds; certain compounds (xylene, toluene) that have MEGs or MCLs are not specifically listed in the Decision Tree.

3.2

POTENTIAL RECEPTORS

There are two primary pathways by which petroleum hydrocarbons may be transported away from the NEX. These include transport in dissolved form in groundwater and transport as vapors in unsaturated soil. Based on these two potential transport mechanisms, the primary potential receptors include: (i) persons working or living in downgradient buildings with subgrade foundations; and (ii) persons with downgradient drinking water wells. As discussed in Section 1.4, vapors have been detected in the past in Building 27 (the Family Services Center) as well as in storm drain manholes located to the west of Building 27. Therefore, this potential pathway is a realistic concern. Exposures via ingestion of drinking water are not expected to occur, since the nearest drinking water wells are located on Coombs Road approximately one mile to the southeast of the NEX.

Another potential pathway involves transport to surface water. Dissolved hydrocarbons could migrate to a surface water body where they would either be volatilized or transported in dissolved or adsorbed form. Potential receptors in this case would be flora and fauna in the surface water body which could then be consumed or handled by humans.

The closest surface water body to the NEX is a tributary to Mere Brook approximately 1,400 feet downgradient (southeast). The tributary travels approximately 2,000 feet before meeting Mere Brook, which discharges into Harpswell Cove located two miles to the south. Immediately upgradient of the tributary is a National Priority List (NPL) hazardous waste site referred to in a Department of the Navy Remedial Investigation Report (E.C. Jordan, 1990) as Site 9 -- Neptune Drive Disposal Site. Several monitoring wells have been installed at Site 9 to determine groundwater quality. Chlorinated hydrocarbons were detected at low microgram per liter (ug/l) levels, as well as inorganic compounds. No petroleum hydrocarbons were detected in these six monitoring wells over four sampling rounds. Based on this information, it is probable that the

groundwater contamination from the NEX had not yet migrated to the tributary to Mere Brook. Therefore, groundwater contamination does not appear to be currently impacting surface water quality at the site.

Based on permeability values measured by ERM in NEX monitoring wells, groundwater seepage velocity is estimated to be approximately 0.39 feet per year. The Navy Remedial Investigation Report estimated a groundwater seepage velocity (based on permeability testing in wells near the tributary) of 9 to 104 feet per year. Using an assumed seepage velocity of 105 feet per year (a very conservative value for the NEX), the travel time to the tributary, without taking into account adsorption and degradation, would be a minimum of 13 years. Significant contaminant degradation, dilution, and adsorption would likely occur during this time period. Therefore, although it is theoretically possible for the contaminants detected at the NEX to eventually reach the tributary, their concentration would likely be significantly reduced.

RESULTS AND INTERPRETATION

SITE GEOLOGY

Characterization of the site geology is based on the classification of soil samples collected from soil borings advanced for monitoring well installation. The subsurface geology of the site is characterized by a surficial layer of brown silty loam, overlying a medium to fine tan, brown, and gray sand containing a trace (less than ten percent) of silt, overlying a soft gray marine clay.

The upper loam unit is of variable thickness; absent at the northern portion of the site (MW-1), up to seven feet thick beneath the front lawn of the Family Service Center (MW-2), and absent along the south side of this facility (MW-5). The sandy layer is greater than 16 feet thick in the northern portion of the site (MW-1) and thins to less than 4 feet to the south (MW-5). The underlying marine clay was encountered at depths ranging from 8.5 feet to 14 feet below ground surface at three of the five borings (MW-2, 3, and 4), at 5 feet in MW-5, and not encountered in MW-1.

Information concerning subsurface stratigraphy on site was also available from one soil boring advanced at the NEX service station in 1974. This boring was performed for the purpose of providing geotechnical information for construction of a building addition. Correlation of the current and previous logs indicate that the upper sand unit extends to a depth of 22.5 feet, and the clay layer to 93.5 feet, below ground surface. Two feet of sand and gravel were reported to underlie the clay layer, and bedrock was reported at 95.5 feet. The exact location of this boring is unknown.

SITE HYDROGEOLOGY

Groundwater elevation contour maps for the May and June gauging events are included as Figures 4 and 5, respectively. Groundwater elevations and survey data are summarized in Table 1. Groundwater beneath the site flows to the south with a slight steepening of the horizontal gradient to the south of Burbank Avenue (from approximately 0.005 feet/foot to 0.02 feet/foot). The increasing horizontal gradient and southern flow direction correlates well with the site topography, which also slopes gently to the south on the south side of Burbank Avenue.

Therefore, the primary direction of contaminant transport in groundwater is expected to be the south of the NEX service station.

Hydraulic conductivities of the upper sand unit and lower marine clay were calculated based on variations in groundwater elevation recorded during rising head permeability tests. The hydraulic conductivity in each of these wells was identical, estimated at 8.6×10^{-6} cm/sec. Slug test data is compiled in Appendix C.

The hydraulic conductivities measured represent a single point in the aquifer. Typical values of hydraulic conductivity for a silty sand unit range from approximately 1.0×10^{-1} to 1.0×10^{-5} cm/sec, and for an unweathered marine clay from approximately 1.0×10^{-7} to 1.0×10^{-10} cm/sec. Therefore, estimated hydraulic conductivities for each well are lower than would be expected for the upper sand unit, and slightly higher than would be expected for a marine clay.

Possible explanations for the results obtained include; inhomogeneities in subsurface stratigraphy (e.g., a higher silt content in both the sand and clay units, decreasing the hydraulic conductivity of the former and increasing that of the latter, respectively), a breach in the bentonite seal in MW-5 (increasing the hydraulic conductivity of the clay), or a more permeable clay than expected (due to unidentified silt lenses within the formation).

In summary, based on groundwater elevation data the predominant direction of groundwater flow is to the south of the NEX service station. Subsurface soils in the vicinity of monitoring wells MW-4 and MW-5 are characterized by relatively low hydraulic conductivities. Low hydraulic conductivities may inhibit the migration of dissolved phase contamination in groundwater via advective flow.

4.3

SOIL GAS SURVEY

Soil gas measurements collected at each monitoring station are summarized in Table 2. The maximum concentration of total VOCs detected at each sampling location is summarized in Figure 3 (peak PID values are shown on Figure 3 by convention as a worse case scenario). Original data sheets and field observations are contained in Appendix D.

Concentrations of total VOCs recorded during the soil gas survey ranged from 0.0 ppm (SG-36) to 1,211 ppm (SG-17) above background. With the exception of station SG-19A (10.8 ppm), soil gas readings to the south of Burbank Avenue and to the west of Second Street were below 5.0 ppm. The highest readings (greater than 100 ppm) were confined to the eastern

side of the NEX service station downgradient of the three 10,000 gallon USTs and adjacent to the feed lines connecting the USTs to the pump island (Figure 3). There may be a correlation with paved vs. unpaved conditions in that the pavement may trap gasoline vapors. However, no other correlation between results obtained in paved and unpaved areas was noted.

The results of the soil gas survey suggest that the source of VOCs detected in soil gas may be attributed to a release(s) of gasoline from the UST system. The release appears to have occurred either at the USTs, or along the feeder lines connecting the USTs to the pump island.

Based on the results of the soil gas survey the location of monitoring well MW-4 was changed from the proposed location at the corner of Burbank Avenue and Second Street, to the area of highest soil gas readings; adjacent to and downgradient of the USTs and the feed lines connecting the USTs to the pump island.

4.4

ANALYTICAL QUALITY ASSURANCE

ERM conducted an analytical quality assurance review of laboratory results for soil samples collected on May 16, 1992 and groundwater samples collected on May 21, 1992. The sample locations, collection dates, ERM and laboratory sample identification numbers, and analyses performed are summarized in Table 3. ERM's *Analytical Quality Assurance Report* including the analytical methods and references used to perform the laboratory analyses is provided in Appendix B. Qualified and validated analytical results for both soil and groundwater, are summarized in Tables 4 and 5, respectively.

The following criteria were used to review all laboratory data: chain of custody documentation, holding times, blank analyses, and surrogate compound recoveries. All results have been validated or qualified according to general guidance provided in the "Laboratory Data Validation Functional Guidelines for Evaluating Organic (and Inorganic) Analyses" (USEPA 2/88 and 6/88).

Sample detection limits reported in analyses of fuel oil in soil samples were 35 milligrams per kilogram (mg/kg). This value exceeds the Maine DEP cleanup goal of 10 mg/kg for fuel oil in soil (refer to Section 4.1). Re-evaluation of the chromatograms for soil analyses indicated that sample detection limits for analyses of fuel oil in soil could be reported at 10 mg/kg. The lower detection limits are reported in Table 4 (Soil Analytical Results).

Organic and inorganic analyses of soil and groundwater were qualified as acceptable, based on the criteria evaluated. With the exception of the one change noted above, analyses of soil and groundwater can be accepted as quantitatively and qualitatively valid as originally reported.

4.5

SOIL SAMPLING RESULTS

Analytical results of soil samples and associated blanks are summarized in Table 4. Laboratory reports are included as Appendix E.

The highest concentrations of contaminants in soil were detected in the sample collected from MW-4. All compounds analyzed for were detected in this sample except total lead. Benzene, toluene, ethylbenzene, and total xylene (BTEX) were detected at a total concentration of 2,785,300 micrograms per kilogram (ug/kg). BTEX constituents ranged from 5,300 ug/kg (benzene) to 1,800,000 ug/kg (xylene). Other contaminants detected at MW-4 included total petroleum hydrocarbons (TPH) at 1,000 mg/kg, methyltert butyl ether (MTBE) at 7,300 ug/kg, and gasoline and fuel oil in soil at 31,000 mg/kg and 4,800 mg/kg, respectively.

Analysis of the soil sample collected from MW-1 indicated that contaminants were not detected above method detection limits in any of the analyses performed. These results suggest that MW-1 represents an appropriate background location, upgradient of the UST system.

Analyses of soil samples collected from borings MW-2, MW-3, and MW-5 exhibit significantly lower concentrations of contaminants in soil (relative to the results from MW-4). Contaminants detected in these samples include total lead at MW-3 (13 mg/kg) and MW-5 (20 mg/kg), TPH at MW-3 (30 ug/kg) and MW-5 (13 ug/kg), and MTBE at MW-3 (3.6 ug/kg). BTEX, gasoline, and fuel oil were not detected in soil samples collected from the borings for MW-1, 2, 3, and 5.

Borings for wells MW-2, 3, 4, and 5 are all located downgradient of the boring for MW-4. The soil sample from each of these borings was collected from a depth representative of saturated soil (below the water table). The lower levels of contaminants detected in these samples are attributed to migration in groundwater from an upgradient release located near MW-4.

The equipment blank from split spoon sampling and the trip blank for soil sampling were not found to contain detectable levels of the parameters for which they were analyzed (Table 4).

Water used for drilling and decontamination was obtained from a base fire hydrant and transported in a water truck. A source water sample was

collected from the tank of the water truck and analyzed to document the quality of the water used for drilling and decontamination. Analyses for this sample indicate the presence of 12 micrograms per liter (ug/l) and 21 ug/l of fuel oil and gasoline, respectively (Table 4). The most likely source of these contaminants is the water truck tank used to transfer water from the fire hydrant to the point of use. State of Maine Maximum Exposure Guidelines (MEGs) and federal Maximum Contaminant Levels (MCLs) for these parameters are summarized in Table 3-1. State guidelines and federal standards were not exceeded in this sample. However, the presence of these contaminants at low levels in the source water should be taken into consideration in interpretation of groundwater analyses.

4.6

GROUNDWATER SAMPLING RESULTS

Analytical results for groundwater samples and associated blanks are summarized in Table 5. Applicable State of Maine Maximum Exposure Guidelines (MEGs) and federal Maximum Contaminant Levels (MCLs) for groundwater are summarized in Table 6. Boxed values in Table 5 represent concentrations in excess of MEGs or MCLs. The distribution of contaminants detected in groundwater is displayed in Figure 6. Laboratory reports are included in Appendix E.

Similar to the results of soil analyses, the highest concentrations of contaminants in groundwater were detected in the samples from monitoring well MW-4. Contaminants at this location include BTEX (at a total concentration of 38,900 ug/l), TPH (22 milligrams per liter or mg/l), MTBE (2,000 ug/l), and gasoline (230 mg/l) and fuel oil (210 mg/l) in water. Dissolved lead was not detected above method detection limits in samples from MW-4, or any other groundwater samples analyzed. Constituent concentrations of BTEX at MW-4 ranged from 1,000 ug/l (benzene) to 22,000 ug/l (total xylene). Detected concentrations of BTEX, gasoline, and fuel oil at MW-4 exceed both state MEGs and federal MCLs.

Contaminants in other groundwater samples, excluding MW-4, were detected at significantly lower concentrations. BTEX was detected in samples from wells MW-2 and MW-3, at total concentrations of 4.3 ug/l and 59.8 ug/l, respectively. BTEX was not detected in groundwater samples from MW-1 and MW-5. MTBE was detected in MW-3 (2.5 ug/l) and MW-5 (5.9 ug/l). Contaminants exceeding state MEGs and federal MCLs in samples exclusive of MW-4 included benzene, detected at 14 ug/l at MW-3, gasoline in water at 56 ug/l at MW-5, and fuel oil in water at MW-2 (460 ug/l), MW-3 (61 ug/l), and MW-5 (300 ug/l).

Fuel oil was detected in all analyses of groundwater samples, including the upgradient well MW-1 (0.01 mg/l). The occurrence of fuel oil in MW-

1 at concentrations below state MEGs may have originated from the source water used during well installation, as fuel oil was detected at 12 ug/l in the analysis of the source water. Alternatively, the presence of fuel oil in the sample from the upgradient well may also represent laboratory contamination introduced during sample analysis.

Results of field analyses of pH and conductivity are summarized in Table 7. Values for pH ranged from 5.77 in MW-1 to 6.68 in MW-5. Conductivity ranged from 232 micromhos per centimeter (uhmo/cm) in MW-1 to 369 uhmo/cm in MW-4. Measured field parameters do not suggest an adverse impact to groundwater quality in the area of investigation.

4.7

SUMMARY AND INTERPRETATION OF RESULTS

Chemical analyses of both soil and groundwater indicate the highest concentrations of contaminants were detected at monitoring well MW-4 located on the east side of the NEX service station. Correlation of the existing analytical data with results of the soil gas survey and the reported history of environmental activity at the site suggest that the source of soil and groundwater contamination was a release of gasoline from the UST system located at the NEX service station.

The USTs system at the NEX service station is currently inactive, therefore existing soil and groundwater contamination is attributed to a former release from the UST system. The existing data suggests that soil contamination may be restricted to the NEX service station in the area located immediately to the south/southwest of the three 10,000 gallon gasoline USTs and adjacent to subsurface piping connecting the USTs to the pump island. The lateral and vertical extent of soil contamination remains undefined. Soil contamination represents a continued potential source of groundwater contamination.

Groundwater contamination in excess of state MEGs and federal MCLs has been detected at, and to the south of, the NEX service station. Gasoline and fuel oil were identified in groundwater at levels in excess of state MEGs extending to the west and south of the Family Service Center (Building 27). The extent of groundwater contamination currently remains undefined.

Based on the application of appropriate cleanup guidelines and identification of potential receptors, soil and groundwater contamination on site require remediation to remove petroleum hydrocarbon contamination. The primary exposure pathway for current and foreseeable human receptors is by inhalation of vapors migrating into downgradient structures. Based on the application of Main DEP's

Decision Tree, "strict" cleanup criteria which apply to contamination detected at the NEX include soil remediation to 10 mg/kg total fuel oil, or 5 mg/kg total gasoline, and groundwater remediation to 50 ug/l total hydrocarbons, 50 ug/l MTBE, and/or 5 ug/l benzene.

Soil contamination at MW-4 exceeds DEP cleanup criteria. Detected concentrations of fuel oil and gasoline were below cleanup criteria in soil samples from other locations. Except for the upgradient monitoring well (MW-1), groundwater contamination on site exceeds cleanup goals and therefore requires remediation. The area and volume of soil and groundwater contamination requiring remediation remains undefined.

REMEDIAL ALTERNATIVES FOR SOIL

ERM has reviewed potential soil treatment technologies and determined that based on the nature of the contaminants detected at the site, the following options should be evaluated for remediation. The initial screening of technologies was focused on those options that would be effective on the contaminants of concern at the site (petroleum hydrocarbons). Some of the other factors considered in reducing the list of available technologies were cost considerations, availability, ease of implementation, and ability to limit or eliminate future liability.

The costs shown in this section give a general scale of capital cost investment for a given technology. The costs presented here do not focus on specific site conditions other than types of contaminants since the extent of soil and groundwater contamination remains unknown. Site-specific costs should be determined after further investigation to determine the aerial extent of soil and groundwater contamination.

In addition, it should be noted that prior to final design of a remedial alternative, it may be necessary for vendors to perform some bench-scale or pilot-scale studies to determine actual conditions for their specific systems. These items can be defined in the final design phase after agreement has been reached outlining a final treatment approach.

Excavation and Off-Site Disposal

Excavation and disposal has long been the most viable option for remediation of soil contaminated with TPH and related constituents. This technology includes the excavation of the contaminated soil, disposal in an off-site facility, and backfilling of the open hole with clean fill material. However, with the rising cost of landfill space and the ongoing liability retained by the generator of the contaminated soil, other options involving soil treatment are becoming more widespread and commonplace.

Soil Vapor Extraction

Soil vapor extraction operates on the principal of increasing the relative volatility of VOCs compared to normal conditions in a subsurface soil region. By introducing a vacuum in a subsurface region of VOC

contaminated soil, air flow is induced through the pore spaces of the region towards the vacuum source. This will cause VOC contaminants to volatilize from the pore spaces in the soil matrix and disperse into the vacuum-induced air stream. VOCs are thus continuously removed from the soil.

Because subsurface soil conditions vary greatly from site to site, it is necessary to measure specific characteristics of the region to which a vacuum is applied in order to design a full scale system. A pilot scale system is used to establish the feasibility of vapor extraction at a given site by measuring characteristics such as:

- 1) The radius of influence of the vacuum at discrete distances from the source: This will establish the radius of the vacuum influence which in turn dictates the size of the lateral area addressed by a single well. Given the areal extent of contamination, the total number of wells needed to achieve the remedial objectives can be determined.
- 2) The air flow rate: The soil vapor flow rate will be used to determine the mass flow rate of contaminants and the size of the blower needed for a full scale system.
- 3) The VOC concentrations: The concentrations of VOCs in the vapor stream will be used to estimate the overall feasibility of removal, the emissions to the atmosphere, and any permit or air pollution control requirements.

5.1.3

Bioremediation Treatment

Bioremediation generally refers to the breakdown of organic compounds (contaminants) by microorganisms. In situ, solid-phase, slurry-phase, soil heaping and composting biological treatment techniques can be used to remediate contaminated soils. The following types of bioremediation could be considered viable options for treatment of the contaminated soils at the NEX site.

In Situ Bioremediation

In situ bioremediation involves enhancing the microbial degradation of contaminants in subsurface soil without excavation of the overlying soil. The technology usually involves enhancing natural biodegradation processes by adding nutrients, oxygen (if the process is aerobic), and in some cases microorganisms to stimulate the biodegradation of contaminants. If oxygen is the rate limiting parameter, hydrogen peroxide is usually added to increase the amount of oxygen available for the biodegradation of the contaminants.

In situ bioremediation has primarily been used for the treatment of saturated soils. However, in a few instances, the technology has been used to treat unsaturated soils. The in situ bioremediation of unsaturated soils has typically been limited to fairly shallow depths over groundwater which is already contaminated. The treatment of unsaturated soils is difficult to control, and relies on using percolation techniques to introduce nutrient-adjusted water, and vacuum extraction techniques to enhance air exchange in the soil matrix.

Solid-Phase Bioremediation (Land Treatment)

In solid-phase bioremediation, excavated soil is placed in an above-grade soil treatment area. If required, nutrients and microorganisms are added to the soil, which is tilled at regular intervals to optimize aeration and contact between the microorganisms and the contaminants. During the operation of a solid-phase bioremediation system, pH, nutrient concentrations and moisture content are maintained within ranges conducive to microbial activity.

Solid-phase bioremediation is a process that treats soils using conventional soil management practices to enhance the microbial degradation of contaminants. The process can be designed to contain and treat soil leachate and volatile organic compounds.

Soil Heaping

Soil heap bioremediation involves piling contaminated soil in heaps of several meters in height. Aeration is usually provided by pulling a vacuum through the heap. Simple irrigation techniques are generally used to maintain moisture content, pH and nutrient concentrations within ranges conducive to the biodegradation of contaminants. The system can be designed to control the release of volatile organic compounds by passing the exhaust from the vacuum through activated carbon.

Site specific parameters such as permeability, available treatment area, schedule and cost are used to determine which of these biological treatment processes is most appropriate for a particular site.

5.1.4

Asphalt Batching

Asphalt batching is a remedial technique that includes reuse of soils contaminated with petroleum hydrocarbons in asphalt production operations. Since the contaminants are similar in nature to the base mixture of the asphalt, the soil materials blend into the asphalt and

become part of the final product. The main advantages of this type of treatment are the relatively low cost and the fact that after treatment, future liability for the materials is ended. One major drawback to this technology is that since there is becoming a large demand, asphalt batchers are becoming very particular in accepting materials. Generally, only soils that can be documented as having a known contaminant source (not waste oils) are being considered.

5.2

COST COMPARISON OF SOIL REMEDIATION ALTERNATIVES

The following table provides a range of costs for treatment of contaminated soils by each of the technologies outlined above.

<u>Treatment Technology</u>	<u>Cost Range</u>
Excavation and Off-Site Disposal	\$150-\$250 per ton
Soil Vapor Extraction	\$50-\$150 per ton*
Bioremediation	\$50-\$100 per ton*
Asphalt Batching	\$50-\$100 per ton

*These technologies may involve some additional pilot-scale or treatability testing prior to implementation.

5.3

REMEDIAL ALTERNATIVES FOR GROUNDWATER

ERM has reviewed potential groundwater treatment technologies and determined that based on the nature of the contaminants detected at the NEX the following options should be evaluated.

5.3.1

Air Sparging

Air sparging is an *in-situ* method of removing the VOC contamination in the shallow portion of the groundwater. The strength of the vacuum applied to a well in the unsaturated zone is insufficient to cause significant volatilization of the VOCs from the groundwater because the contaminants below the water table are not directly exposed to the vacuum. However, by injecting air directly into the groundwater, the VOCs can be stripped from the water into the air which rises into the soil above. This is a common mass transfer technique and when combined with vacuum extraction, the stripped VOCs are extracted from the

saturated and unsaturated soils and ultimately removed from the subsurface.

5.3.2

Pump and Treat Systems

Groundwater pump and treat systems for the types of contaminants present include treatment by air stripping, carbon adsorption, chemical oxidation, or bioremediation. Each of these technologies are discussed below.

Air Stripping

Air stripping is a common treatment technology for volatile organic compounds. The process involves introducing the groundwater into the top of a treatment column. Air is then passed up through the column, countercurrent to the water flow to facilitate transfer of the volatile compounds from the liquid phase into the air. Recent concerns with off-gas emissions control has increased the overall cost of this type of system, however it remains a very cost-effective and frequently used remediation option.

Carbon Adsorption

Carbon adsorption involves contacting the contaminated groundwater with granular carbon, usually by flow through a series of packed bed reactors. Contaminants are removed from the water through adsorption on to the carbon granules. Carbon is suitable for treating a wide range of contaminants but is very sensitive to floating product, oil and grease, and suspended solids which tend to accumulate on the carbon surface and hinder adsorption of organics.

Chemical Oxidation

The chemical oxidation process consists of adding an oxidizing agent, such as hydrogen peroxide, to a waste stream to convert organics to more highly oxidized intermediates or ultimately to carbon dioxide and water. However, partially oxidized intermediates can sometimes be more or less treatable and toxic than the parent compounds, depending on the reaction pathways followed. Therefore, this technology must be carefully evaluated and pilot-scale testing completed on the water source.

Bioremediation

In pump and treat bioremediation, contaminated groundwater is pumped to the surface for biological treatment and treated in above ground biological reactors. Generally, this type of treatment process relies on conventional techniques developed for aerobic treatment such as activated sludge, sequencing batch, fluidized bed, and fixed film bioreactors. However, anaerobic treatment processes can also be used.

5.4

COST COMPARISON FOR GROUNDWATER REMEDIATION ALTERNATIVES

Costs for treating contaminated groundwater vary according to the concentrations of contaminants in the water, the rate at which the water can be pumped from the ground, the type of technology used for treatment, and the cleanup goals to meet. The following cost comparisons are made for treating groundwater at the NEX.

<u>Treatment Technology</u>	<u>Cost Range*</u>
Air Sparging	\$150,000-\$200,000
Air Stripping	\$100,000-\$150,000
Carbon Adsorption	\$100,000-\$150,000
Chemical Oxidation	\$150,000-\$250,000
Bioremediation	\$75,000-\$125,000

*These costs are capital expenditures based on the preliminary information available for determining potential treatment conditions. Some additional treatability or pilot-scale testing would be necessary before a final cost can be calculated. Costs are based on installation of two recovery wells and assume that off-gas treatment would be required for air sparging and air stripping.

Operation and maintenance (O&M) costs have not been calculated for the systems since actual treatment conditions can not be accurately predicted at this time. However, for a typical operation, air sparging and air stripping would have the lowest O&M costs followed by bioremediation, and finally carbon adsorption and chemical oxidation.

SUMMARY OF REMEDIAL ALTERNATIVES EVALUATION

Selection of the most cost-effective remedial alternative must be based on specific data defining the areas and volume of soil and groundwater contamination requiring remediation. The extent of contamination in both soil and groundwater which exceed cleanup criteria is currently undefined. Therefore, identification of the most cost-effective remedial alternative cannot be made at this time.

If the extent of soil contamination exceeding DEP cleanup criteria is limited to a relatively small volume, a source control measure such as excavation and treatment at a soil batching facility may be an effective and permanent remedy for soil. Alternatively, if soil contamination is extensive, then a combined technology such as Soil Vapor Extraction/Air Sparging (SEV/AS) may be the most effective alternative for remediation of both soil and groundwater.

Based on available information, current cleanup criteria for groundwater are based on DEP's "Stringent Cleanup Goals" which assume the future use of on-site groundwater as drinking water. However, based on current land use, the potential for on-site groundwater to be used as a drinking water source is low. Assuming that the extent of groundwater contamination is limited to the immediate area of the NAS, the potential for groundwater contamination to influence currently identified receptors is also low. Therefore, less stringent cleanup criteria than DEP's "Stringent Cleanup Goals" may be applicable for remediation of contaminated groundwater at this site. This decision must be made by the DEP, based on DEP's review of available information concerning the site.

Cleanup criteria to be applied in the remediation of soil and groundwater should be developed in coordination with the DEP. Development of remediation criteria should be based on a more comprehensive understanding of the extent of soil and groundwater contamination and cleanup criteria approved by the DEP.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Based upon the results of the investigation performed, ERM makes the following conclusions regarding conditions at the site.

- The presence at the site of gasoline and fuel oil contaminated soil and groundwater has been confirmed by this investigation. The highest concentrations of soil and groundwater contamination were detected in the vicinity of MW-4, located immediately downgradient of the UST system. The USTs and feed lines leading to the pump island represent the probable source of gasoline release.
- The investigation results indicate that soil contamination is apparently restricted to the NEX service station property. However, this conclusion is based on limited soil information. Soil contamination represents a potential continued source of release to groundwater.
- The direction of groundwater flow in the study area has been established by this investigation. Based on groundwater depth information collected and elevations established by survey, the direction of groundwater flow in the study area is towards the south (towards the west end of the Family Service Center). The depth to groundwater ranges from approximately 3.5 to 7.5 feet across the study area.
- The investigation results indicate that groundwater contamination has apparently migrated from the NEX service station downgradient to the west and south of the Family Service Center. Concentrations of contaminants in groundwater at the service station are significantly greater than concentrations downgradient, however concentrations in all monitoring wells except MW-1 (upgradient of the UST system) exceed state MEGs for fuel oil and/or gasoline. The extent of soil and groundwater contamination at the site remains undefined.
- Low levels of gasoline and fuel oil were detected in the source water used for drilling. The most probable source of this contamination is the water truck tank used to transfer water from the source (fire hydrant) to the point of use. Detected

concentrations are below applicable state guidelines and do not affect the overall conclusions.

- Based on application of Maine DEP's Decision Tree, soil and groundwater contamination in the vicinity of the NEX requires remediation. The Decision Tree contains cleanup guidelines suggesting remediation of contaminated soil to 10mg/kg total fuel oil or 5 mg/kg total gasoline and groundwater remediation to 50 ug/l total hydrocarbons, 50 ug/l MTBE, or 5 ug/l benzene. The Maine DEP needs to be consulted to establish cleanup criteria.
- Identification of the most cost-effective alternative for remediation of soil and groundwater cannot be made at this time, as this selection requires establishment of cleanup criteria and definition of the extent of soil and groundwater contamination.

6.2

RECOMMENDATIONS

Based upon the investigation performed and the conclusions detailed above, ERM makes the following recommendations:

- Establish site and media-specific cleanup criteria in coordination with the Maine DEP.
- Following establishment of site and media-specific cleanup criteria, perform additional sampling and analysis of soil and groundwater to determine the extent of contamination and the areas and volumes of contaminated soil and groundwater requiring remediation. A comprehensive, yet cost-effective sampling program should be initiated involving a combination of rapid sampling and field screening assessment techniques. ERM recommends the following components to this sampling program:
 - Rapid collection of soil and groundwater samples over a sampling grid established near MW-4 using ERM's Fast Well System.
 - Screening soil and groundwater samples in ERM's mobile laboratory for gasoline and benzene using a portable gas chromatograph.
 - Laboratory analysis of a limited number of soil and groundwater samples to confirm the results of field screening.
- At the time the draft report was reviewed by the Navy, ERM was informed that there is an underdrain system on the north side of

Building 27 (the Family Services Center). The underdrain system is part of the building foundation and discharges to the storm water system on the east and west sides of the building. Subsequent site investigation activities should include evaluation of this underdrain system and its impact on groundwater flow and contaminant migration and potential receptors.

- The site-specific remedial alternatives presented in this report should be evaluated based on the site and media-specific cleanup criteria established in coordination with the Maine DEP and the volume of contaminated soil and groundwater determined to require remediation. The selected remedial alternative(s) should be presented to the Maine DEP for approval. Implementation of the remedial action should be performed in accordance with all applicable state and federal guidelines.

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TABLE 1
Ground Water Elevations
Brunswick Naval Air Station
Brunswick, Maine

Well	Measuring Point	MPE	DTW 15-May-92	GWE 15-May-92	DTW 23-Jun-92	GWE 23-Jun-92
ERM-1	PVC	67.21	7.34	59.87	7.57	59.64
ERM-2	PVC	65.32	6.12	59.20	6.54	58.78
ERM-3	PVC	64.34	6.71	57.63	6.84	57.50
ERM-4	PVC	66.46	7.15	59.31	7.38	59.08
ERM-5	PVC	60.48	3.15	57.33	3.38	57.10

Notes:

MPE = Measuring Point Elevation

DTW = Depth to Water

GWE = Ground-Water Elevation

All elevations determined relative to NGVD (sea level) as measured relative to a reference benchmark located at Building 7 on Orion Street.

TABLE 2
Soil Gas Survey Results
Brunswick Naval Air Station
Brunswick, Maine

Sample I.D.	Maximum PID Reading in PPM	Stabilized PID Reading in PPM	Sample I.D.	Maximum PID Reading in PPM	Stabilized PID Reading in PPM
SG-1	3.1	1.9	SG-23	401	89.3
SG-2	3	1.3	SG-24	3.6	3.4
SG-3	6.1	4.4	SG-25	1.3	1.2
SG-3A	0.6	0.5	SG-26	2.9	2.8
SG-4	9.2	9.2	SG-27	0.7	0.4
SG-5	1.6	1.4	SG-28	1.4	1.3
SG-6	0.1	0	SG-29	2.1	1.3
SG-7	670	245	SG-30	3.6	3.3
SG-7A	987	105	SG-31	1.9	0.6
SG-8	5	3.2	SG-31A	1.2	0.8
SG-8A	7.1	2	SG-32	1.1	1.1
SG-9	6.6	3.5	SG-32A	2.8	2.6
SG-10	4.7	2.9	SG-33	3	2.9
SG-11	1027	1003	SG-34	0.4	0.2
SG-12	873	810	SG-34A	2.6	2.1
SG-13	5.7	5.5	SG-35	1.7	0.4
SG-14	0.7	0.6	SG-36	0	0
SG-15	4.4	2.4	SG-37	0.6	0.3
SG-16	1079	905	SG-38	0.3	0.2
SG-16A	1.5	1.3	SG-39	0.5	0.4
SG-17	1211	1098	SG-40	0.4	0.1
SG-18	0.8	0.6	SG-41	1	0.8
SG-18A	4.98	1.2	SG-42	0.2	0
SG-19	1.3	0.3	SG-43	2.9	2.5
SG-19A	10.8	0.8	SG-44	0.9	0.8
SG-20	2.3	2.3	SG-45	0.9	0.8
SG-21	2	1.9	SG-46	0.7	0.6
SG-22	2.6	2.5			

PID readings in parts per million (PPM) of total volatile organic compounds (VOCs).

TABLE 3
Summary of Sample Data Reviewed
Brunswick Naval Air Station
Brunswick, Maine

<u>Sample Location</u>	<u>Collection Date</u>	<u>Laboratory ID Number</u>	<u>Matrix</u>	<u>Analyses Performed</u>
MW-1 (9-10.5')	5/16/92	92137001	Soil	1
MW-2 (7-8.5')	5/16/92	92137002	Soil	1
MW-3 (7-9')	5/16/92	92137003	Soil	1
MW-4 (7-8.5')	5/16/92	92137004	Soil	1
MW-5 (4-6')	5/16/92	92137005	Soil	1
Source Water	5/16/92	92137006	Water	1
Equipment Blank	5/16/92	92137007	Water	2
Trip Blank	5/16/92	92137008	Water	3
MW-1	5/21/92	92142026	Water	1
MW-2	5/21/92	92142027	Water	1
MW-2D	5/21/92	92142032	Water	2
MW-3	5/21/92	92142028	Water	1
MW-4	5/21/92	92142029	Water	1
MW-4D	5/21/92	92142031	Water	4
MW-5	5/21/92	92142030	Water	1
Trip Blank	5/21/92	92142033	Water	3

Analysis Performed:

- 1 - BTEX Analysis (Benzene, Toluene, Ethylbenzene, Xylenes), Lead, Total Petroleum Hydrocarbons (TPH), Methyltertbutyl Ether, Gasoline in Soil, Fuel oil in soil.
- 2 - Lead.
- 3 - BTEX Analysis, Methyltertbutyl Ether.
- 4 - BTEX Analysis, TPH, Methyltertbutyl Ether, Gasoline, Fuel oil.

TABLE 4
Soil Analytical Results
Brunswick Naval Air Station
Brunswick, Maine

Sample Location	MW-1 (9-10.5')	MW-2 (7-8.5')	MW-3 (7-9')	MW-4 (7-8.5')	MW-5 (4-6')	Source Water	Equipment Blank	Trip Blank
Sample Date	5/15/88	5/15/88	5/15/88	5/15/88	5/15/88	5/15/88	5/15/88	5/15/88
Laboratory Number	92137001	92137002	92137003	92137004	92137005	92137006	92137007	92137008
Matrix	Soil	Soil	Soil	Soil	Soil	water	water	water
Percent Solids	79	82	83	84	81	NA	NA	NA
BTEX Analysis (µg/kg or µg/L)								
Toluene	1.3	U	1.2	U	1.2	U	1	U
Benzene	1.3	U	1.2	U	1.2	U	1	U
Ethylbenzene	1.3	U	1.2	U	1.2	U	1	U
Xylenes (total)	2.6	U	2.8	U	2.4	U	2	U
Lead (total) (mg/kg or mg/L)	10	U	13		10	U	10	U
Total Petroleum Hydrocarbons (mg/kg)	10	U	10	U	30		1,000	
Methyltertbutyl Ether (µg/kg or µg/L)	2.6	U	2.4	U	3.6		7,300	
Gasoline in soil (mg/kg or mg/L)	6	U	6	U	6	U	31,000	
Fuel Oil in soil (mg/kg or mg/L)	10	U	10	U	10	U	4,800	

Qualifiers:

NA - Not Analyzed.

U - This result was analyzed but not detected. The numerical value reported represents the detection limit of the analyte.

TABLE 5
Ground Water Analytical Results
Brunswick Naval Air Station
Brunswick, Maine

Sample Location	MW-1		MW-2		MW-2D		MW-3		MW-4		MW-4D		MW-5		Trip Blank
Sample Date	5/20/88		5/20/88		5/20/88		5/20/88		5/20/88		5/20/88		5/20/88		5/20/88
Laboratory Number	92142026		92142027		92142000		92142028		91242029		92142031		92142030		92142000
BTEX Analysis (µg/L)					NA										
Toluene	1.0	U	1.1				18		11,000		12,000		1.0	U	1.0
Benzene	1.0	U	1.0	U			14		1,000	U	1,000		1.0	U	1.0
Ethylbenzene	1.0	U	1.0	U			4.8		4,000		3,900		1.0	U	1.0
Xylenes (total)	2.0	U	4.2				23		22,000		22,000		2.0	U	2.0
Dissolved Lead (mg/L)	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	NA		0.005	U	NA
Total Petroleum Hydrocarbons (mg/L)	1.0	U	1.0	U	NA		1.0	U	14		22		1.0	U	NA
Methyltertbutyl Ether (µg/L)	2.0	U	2.0	U	NA		2.5		2,000	U	2,000	U	5.9		2.0
Gasoline in Water (mg/L)	0.020	U	0.035		NA		0.02	U	230		210		0.056		NA
Fuel Oil in Water (mg/L)	0.010		0.460		NA		0.061		100		84		0.300		NA

Qualifiers:

NA - Not Analyzed.

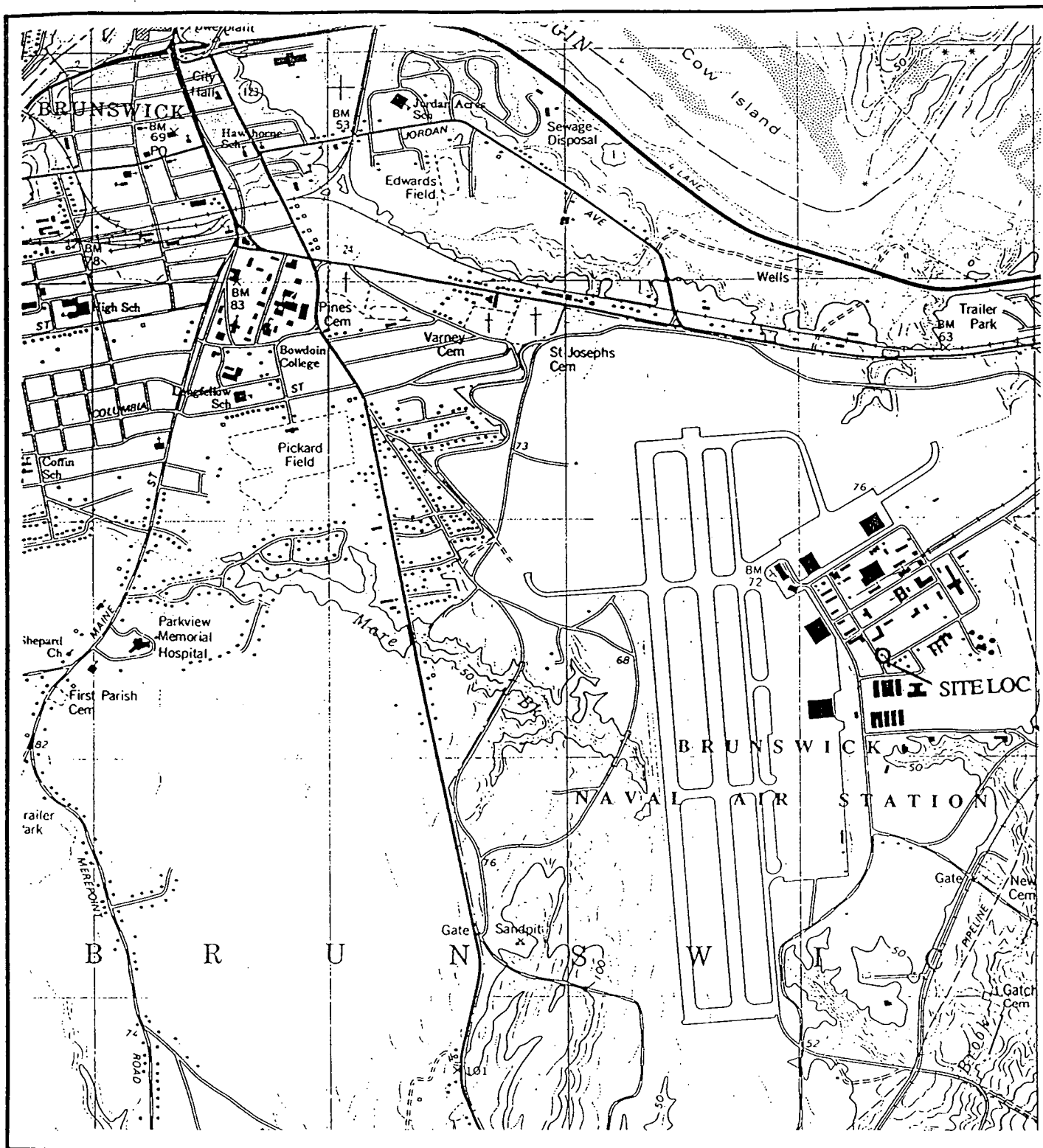
U - This result was analyzed but not detected. The numerical value reported represents the detection limit of the analyte.

Results exceeding Maine MEGs or Federal MCLs are enclosed by a box.

TABLE 6
Ground Water Field Parameters
Brunswick Naval Air Station
Brunswick, Maine

Well	pH 21-May-92	Conductivity* (umho/cm) 21-May-92
MW-1	5.77	232
MW-2	6.37	251
MW-3	6.38	320
MW-4	6.29	369
MW-5	6.68	263

* Conductivity value corrected for temperature

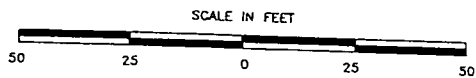


Source: USGS Topographic Map,
Brunswick, ME, 1980

Scale 1:24,000



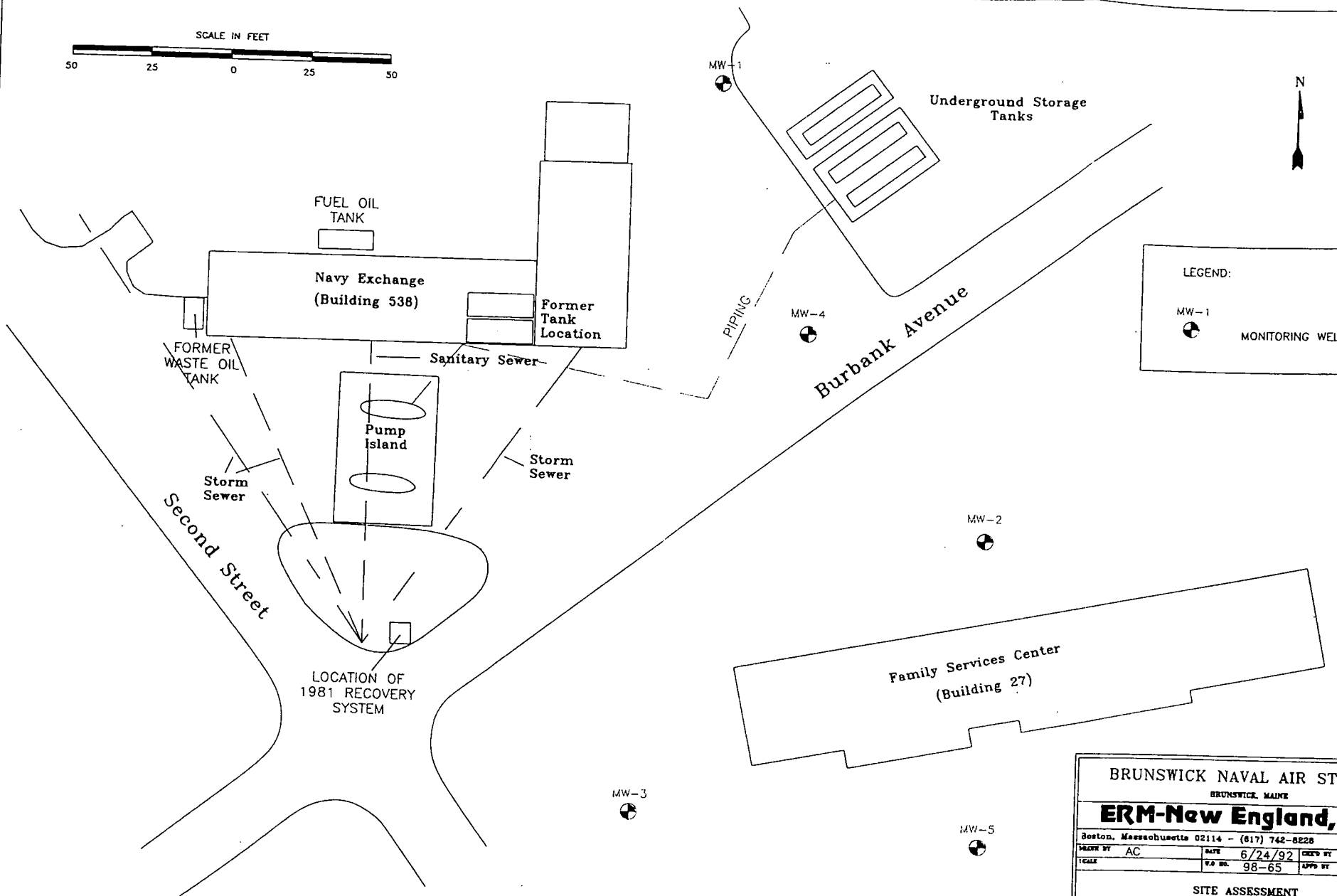
ERM New England	Topographic Location Map
Brunswick Naval Air Station Brunswick, Maine	
Figure 1	July 1992



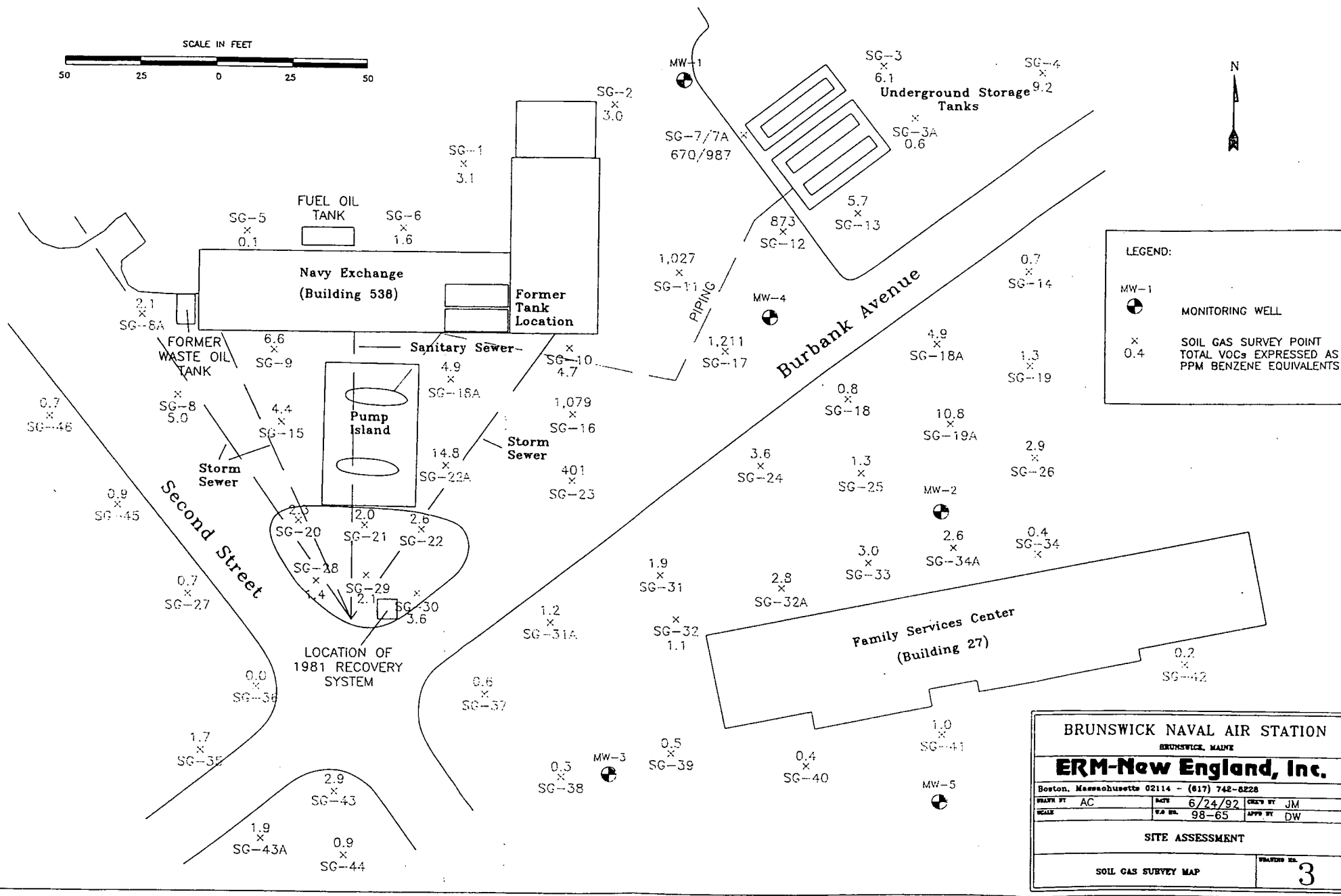
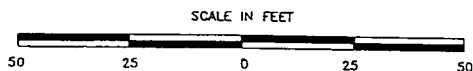
LEGEND:

MW-1

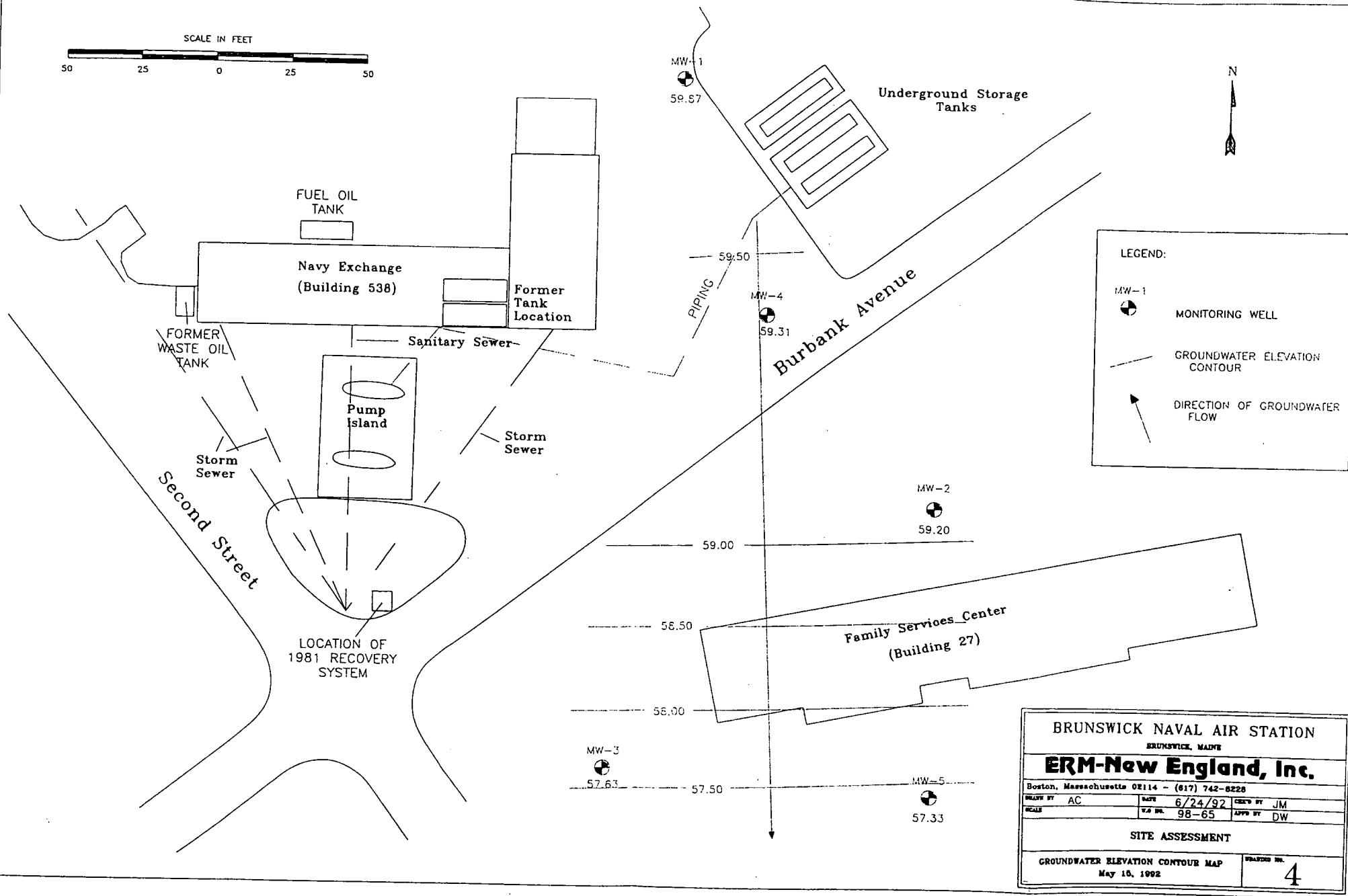
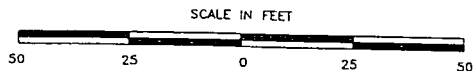
MONITORING WELL

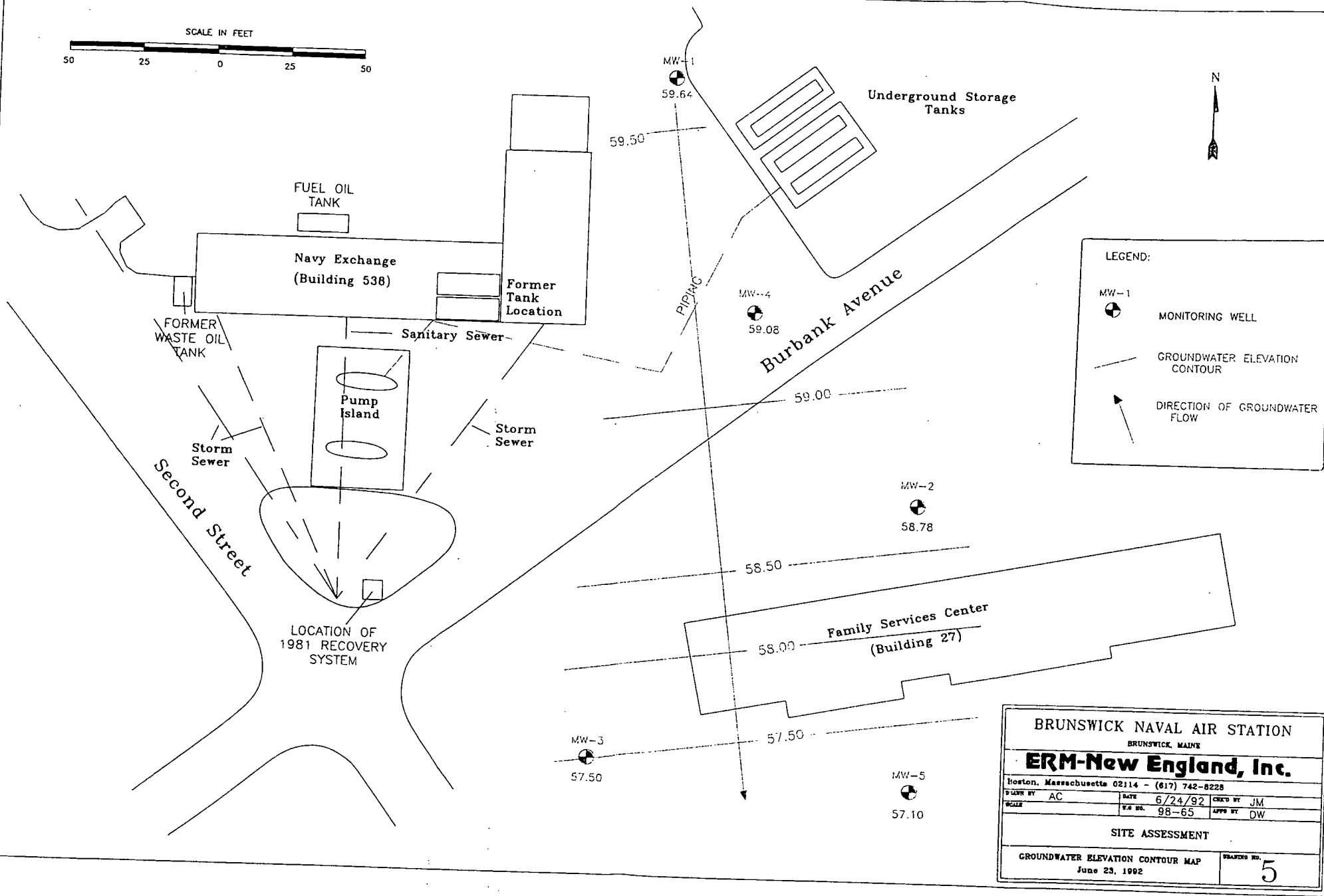
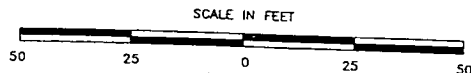


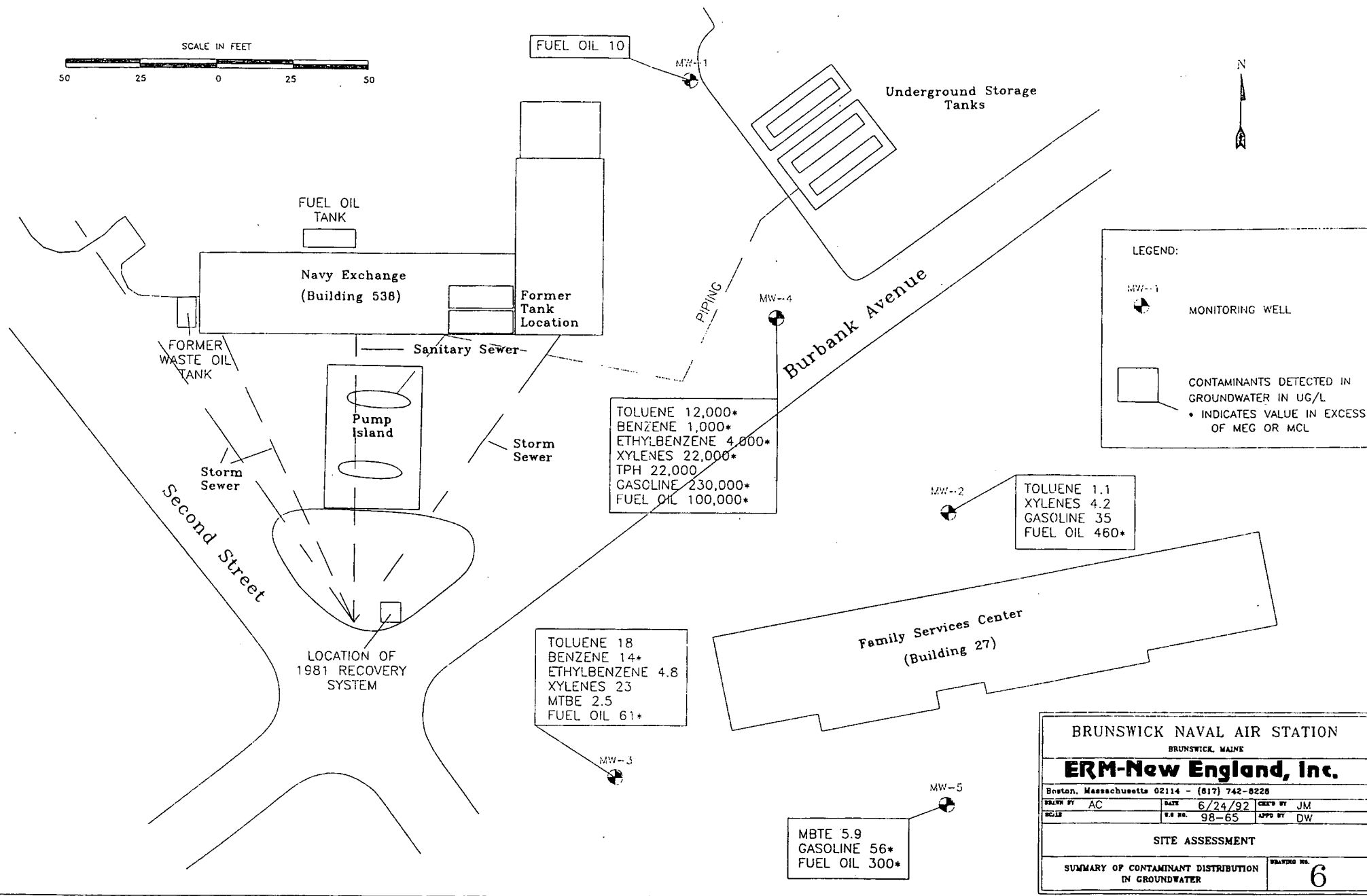
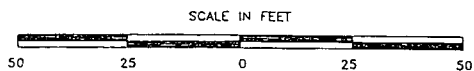
BRUNSWICK NAVAL AIR STATION			
BRUNSWICK, MAINE			
ERM-New England, Inc.			
Boston, Massachusetts 02114 - (617) 742-6228			
MADE BY	AC	DATE	6/24/92
SCALE	98-65	DRAWN BY	JM
		CHECKED BY	DW
SITE ASSESSMENT			
SITE PLAN			PRINTED NO. 2



BRUNSWICK NAVAL AIR STATION			
BRUNSWICK, MAINE			
ERM-New England, Inc.			
Boston, Massachusetts 02114 - (617) 742-8228			
PLANNED BY	AC	DATE	6/24/92
SCALE	1" = 100'	CREATED BY	JM
		APPROVED BY	DW
SITE ASSESSMENT			
SOIL GAS SURVEY MAP			PLANTING NO. 3







BRUNSWICK NAVAL AIR STATION			
BRUNSWICK, MAINE			
ERM-New England, Inc.			
Brunston, Massachusetts 02114 - (617) 742-8226			
DRAWN BY	DATE	CHECKED BY	DATE
AC	6/24/92	JM	
SCALE	S.D. NO.	APPROVED BY	DATE
	98-65	DW	
SITE ASSESSMENT			
SUMMARY OF CONTAMINANT DISTRIBUTION IN GROUNDWATER			DRAWING NO. 6

Appendix A

Soil Boring Logs and Well Installation Programs

Drilling Log

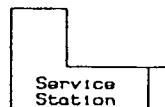
Page 1 of

Well Number: MW-1

ERM - New England, Inc.

Project: Brunswick NAS Project No.: 98-65
 Client: Log by: CD
 Drilling Co.: Avalanche Driller: Steve & Ken
 Date Started: 5/14/92 Date Finished: 5/14/92
 Location: Brunswick NAS, ME Drilling Method: HSA
 Screen - Diameter: 4" Length: 10' Slot Size: 0.010"
 Casing - Diameter: 4" Length: 5' Type: PVC
 Boring Depth: 16' Well Depth: 15' Boring Dia.: 10"
 Surface Elev.: Measuring Point Elevation:
 Measuring Point: grade

Map



MW-1

Notes

water table
at approx.
8.5 ft

Depth	Graphic Log	Well	Sample Number	Blowcounts per 6 inches	Rec.	PID Initial/15 min.	Description/Soil Classification (Color, Texture, Structures)
1							Tan, fine sand, dry. (Soil description based on cuttings off auger flights)
2							
3							
4							
5			S-1 4-5.5'	51-12 18-20	18"	0.0/ 2.1 ppm	Tan, med. fine sand, trace silt; dry; uniform grain size, no gravel.
6							
7							Same as above
8							
9							
10			S-2 9-10.5'	3-4 5	16"	0.0/ 0.7 ppm	Tan, med. fine uniform sand, trace silt, no gravel; moist. BTEX, MTBE, Pb, TPH, Gasoline, and Fuel Oil lab samples collected.
11							
12							Same as above
13							
14							
15			S-3 14-16'	1-1 3-7	15"	0.0/ 0.0 ppm	Tan, med. fine uniform sand, trace silt, no gravel, fine scale lamination; wet
16							
17							WELL CONSTRUCTION: Depth to Bottom 15' Screen 15-5' Sand 15-4' Bentonite 4-2' Grout 2'-grade
18							
19							
20							
21							
22							

ERM - New England, inc.

205 Portland Street

Boston, MA 02114

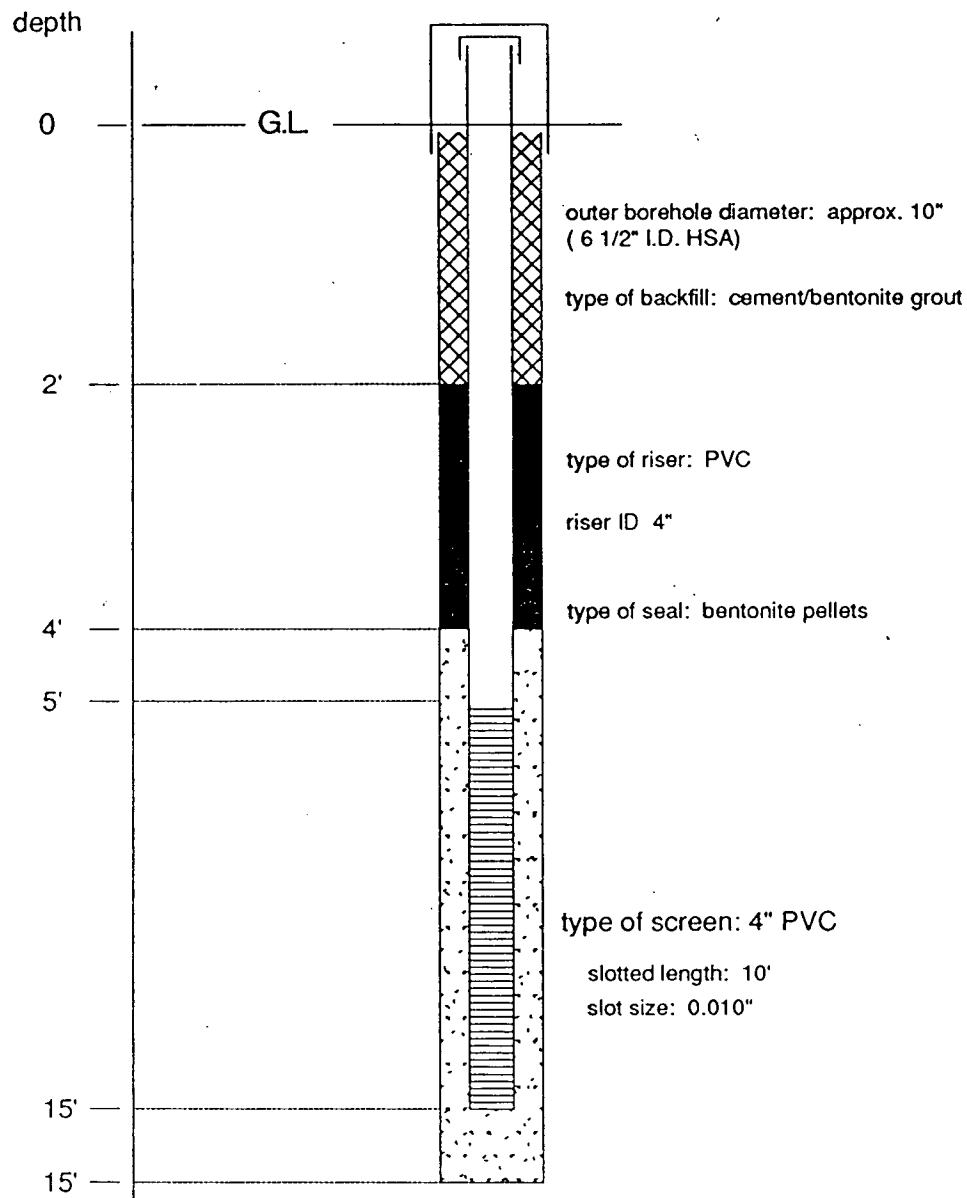
(617) 742-8228

Well Number MW-1

Project Brunswick NAS

Project number 98-65

Date Installed 5/14/92



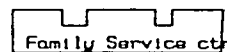
Drilling Log

Well Number: MW-2

ERM - New England, Inc.

Page 1 of

Map



○ MW-2

Burbank Street

Notes

interface between
sand and silty clay
at approx. 7.5 ft

Project: Brunswick NAS Project No.: 98-65
Client: Log by: CD
Drilling Co.: Avalanche Driller: Steve & Ken
Date Started: 5/15/92 Date Finished: 5/15/92
Location: Brunswick NAS, ME Drilling Method: HSA
Screen - Diameter: 4" Length: 10' Slot Size: 0.010"
Casing - Diameter: 4" Length: 4' Type: PVC
Boring Depth: 14' Well Depth: 14' Boring Dia.: 10"
Surface Elev.: Measuring Point Elevation:
Measuring Point: grade

Depth	Graphic Log	Well	Sample Number	Blowcounts per 6 inches	Rec.	PID initial/15 min.	Description/Soil Classification (Color, Texture, Structures)
1							
2							
3							Brown, loamy soil; silt and fine sand texture. (Soil description based on cuttings off augers)
4							
5							
6							
7							
8			S-1 7-8.5'	7-14 17	18"	0.1/ 2.8 ppm	Top 6" orange/brown fine-med. sand, no gravel; bottom 12" brown/grey silty firm clay; damp-moist. BTEX, MTBE, Pb, TPH, Gasoline, and Fuel Oil lab samples
9							
10							Silty, grey clay
11							
12							
13			S-2 12-14	1-1 1-1	24"	0.0/ 0.0 ppm	Soft, grey, silty marine clay; damp-wet
14							
15							
16							
17							WELL CONSTRUCTION:
18							Depth to Bottom 14'
19							Screen 14-4'
20							Sand 14-3'
21							Bentonite 3-1'
22							Grout 1'-grade

ERM - New England, inc.

205 Portland Street

Boston, MA 02114

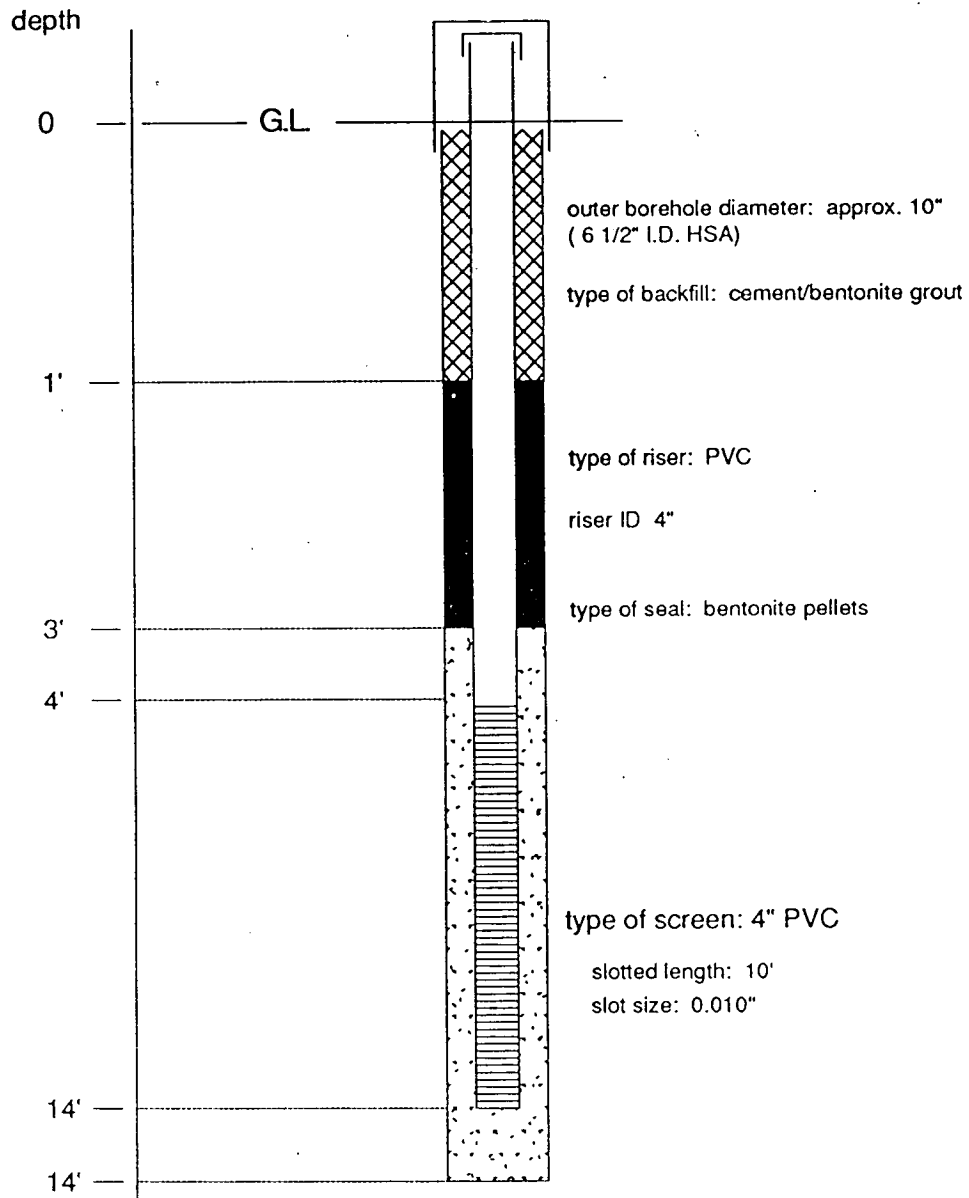
(617) 742-8228

Well Number MW-2

Project Brunswick NAS

Project number 98-65

Date Installed 5/15/92



Drilling Log

Well Number: MW-3

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Page 1 of

Project: Brunswick NAS Project No.: 98-65
 Client: Log by: CD
 Drilling Co.: Avalanche Driller: Steve & Ken
 Date Started: 5/15/92 Date Finished: 5/15/92
 Location: Brunswick NAS, ME Drilling Method: HSA
 Screen - Diameter: 4" Length: 10' Slot Size: 0.010"
 Casing - Diameter: 4" Length: 5' Type: PVC
 Boring Depth: 16' Well Depth: 15' Boring Dia.: 10"
 Surface Elev.: Measuring Point Elevation:
 Measuring Point: grade

Map: Burbank St.

FSC Bld.

MW-3

Steep Slope

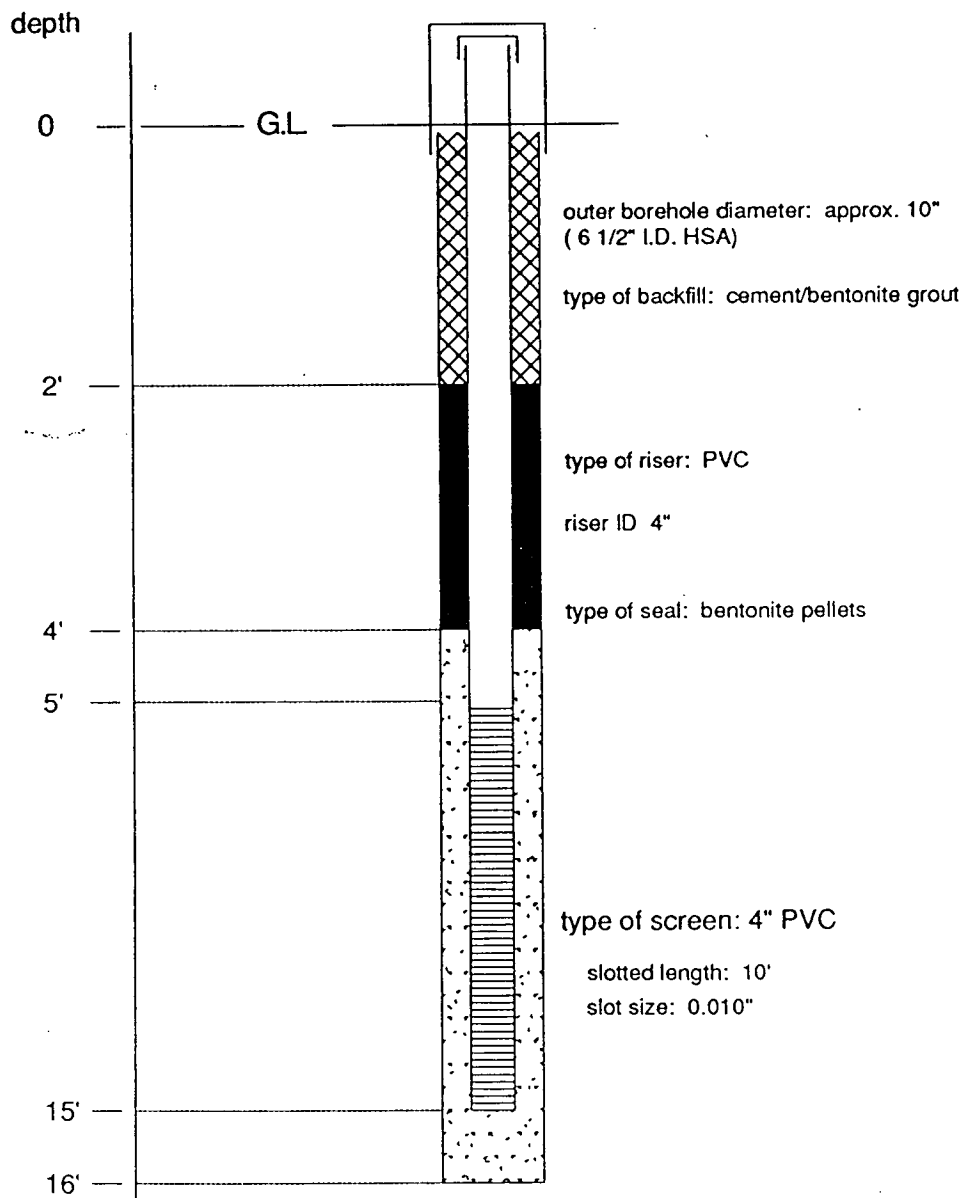
Notes

running/heaving sands

Depth	Graphic Log	Well	Sample Number	Blowcounts per 6 inches	Rec.	PID Initial/15 min.	Description/Soil Classification (Color, Texture, Structures)
1							
2							Brown, organic rich silty loam (soil description based on cuttings off auger flights)
3							
4							
5							
6							Dark brown, silty organic rich loam; moist (based on cuttings)
7							
8			S-1	3-4 7-12	16"	0.0/ 13.4 ppm	Tan/grey fine-med. sand, trace silt; damp to wet. BTEX, MTBE, Pb, TPH, Gasoline, Fuel Oil lab samples collected.
9							
10			S-2	3-6 7-11	19"	0.0/ 0.8 ppm	Top 6" tan/grey, fine-med. sand; bottom 13" bright orange (Fe-oxide/hydroxide rich) fine sand; wet (possible contaminant stimulated biological activity---i.e.-iron bacteria)
11							
12							Grey, soft, silty marine clay at approx. 13 feet (based on cuttings off augers)
13							
14							
15							
16							
17							WELL CONSTRUCTION:
18							Depth to Bottom 15'
19							Screen 15-5'
20							Sand 15-4'
21							Bentonite 4-2'
22							Grout 2'-grade

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Well Number MW-3
Project Brunswick NAS
Project number 98-65
Date Installed 5/15/92



Drilling Log

Well Number: MW-4

ERM - New England, Inc.

Page 1 of

Project: Brunswick NAS Project No.: 98-65
 Client: Log by: CD
 Drilling Co.: Avalanche Driller: Steve & Ken
 Date Started: 5/14/92 Date Finished: 5/14/92
 Location: Brunswick NAS, ME Drilling Method: HSA
 Screen - Diameter: 4" Length: 10' Slot Size: 0.010"
 Casing - Diameter: 4" Length: 5' Type: PVC
 Boring Depth: 15' Well Depth: 15' Boring Dia.: 10"
 Surface Elev.: Measuring Point Elevation:
 Measuring Point: grade

Map

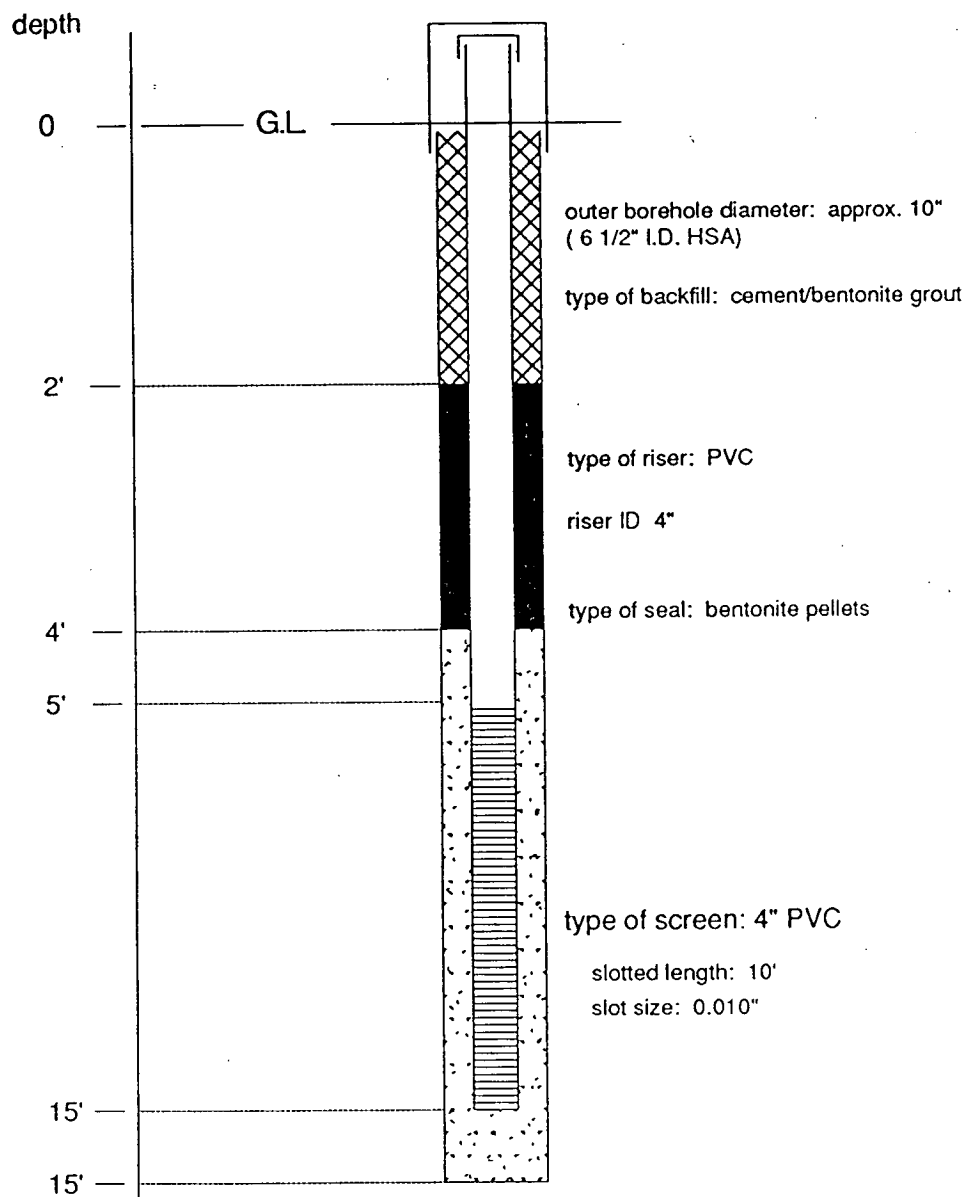
Legend:
 ○ telephone pole
 △ SG-17
 ○ MW-4
 — Burbank St.

Notes
 Level C PPE used during drilling

Depth	Graphic Log	Well	Sample Number	Blowcounts per 6 inches	Rec.	PID Initial/15 min.	Description/Soil Classification (Color, Texture, Structures)
1							147 ppm on PID at approx. 6" depth immediately below pavement (open air reading taken above borehole/cuttings)
2						1373 ppm (0-1') head-space	
3							
4							371 ppm open air reading on PID above borehole
5							
6							
7							
8			S-1 7-8.5'	5-6 9	18"	919/1571 ppm	Tan, med. fine sand, trace silt; damp-moist with strong gasoline odor. BTEX, MTBE, Pb, TPH, Gasoline and Fuel Oil lab samples.
9							
10							1064 ppm PID above hole off cuttings.
11							Tan, med. fine sand (soil description based on cuttings off augers)
12							
13							
14							
15			S-2 14-15.5'	1-3 6	18"	45.1/1133 ppm	Top 13" tan, laminated, very fine sand and silt; bottom 5" blue/gray clayey silt; wet
16							
17							WELL CONSTRUCTION:
18							Depth to Bottom 15'
19							Screen 15-5'
20							Sand 15-4'
21							Bentonite 4-2'
22							Grout 2'-grade

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Well Number **MW-4**
Project **Brunswick NAS**
Project number **98-65**
Date Installed **5/14/92**



Drilling Log

Well Number: MW-5

ERM - New England, Inc.

Page 1 of

Project: Brunswick NAS Project No.: 98-65
 Client: _____ Log by: CD
 Drilling Co.: Avalanche Driller: Steve & Ken
 Date Started: 5/15/92 Date Finished: 5/15/92
 Location: Brunswick NAS, ME Drilling Method: HSA
 Screen - Diameter: 4" Length: 10' Slot Size: 0.010"
 Casing - Diameter: 4" Length: 4' Type: PVC
 Boring Depth: 14' Well Depth: 14' Boring Dia.: 10"
 Surface Elev.: _____ Measuring Point Elevation: _____
 Measuring Point: grade

Map

Family Services Ctr.

Grade ○ MW-5

sidewalk

Pavement/Parking

Notes

Depth	Graphic Log	Well	Sample Number	Blowcounts per 6 inches	Rec.	PID Initial/15 min.	Description/Soil Classification (Color, Texture, Structures)
1							
2							Tan/gray, med. fine sand, some silt, no gravel; damp-moist (Soil description based on cuttings off augers)
3							
4							
5			S-1	2-3 2-3	24"	0.0/ 3.3 ppm	Gray, silty, soft marine clay; damp-wet
6							
7							Gray clay (based on cuttings)
8							
9							
10			S-2	1-1 1-1	24"	0.0/ 0.0 ppm	Gray, soft marine clay; wet
11							
12							Gray clay (based on cuttings)
13							
14							
15							
16							
17							WELL CONSTRUCTION:
18							Depth to Bottom 14'
19							Screen 14-4'
20							Sand 14-3'
21							Bentonite 3-1'
22							Grout 1'-grade

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205 Portland Street

Boston, MA 02114

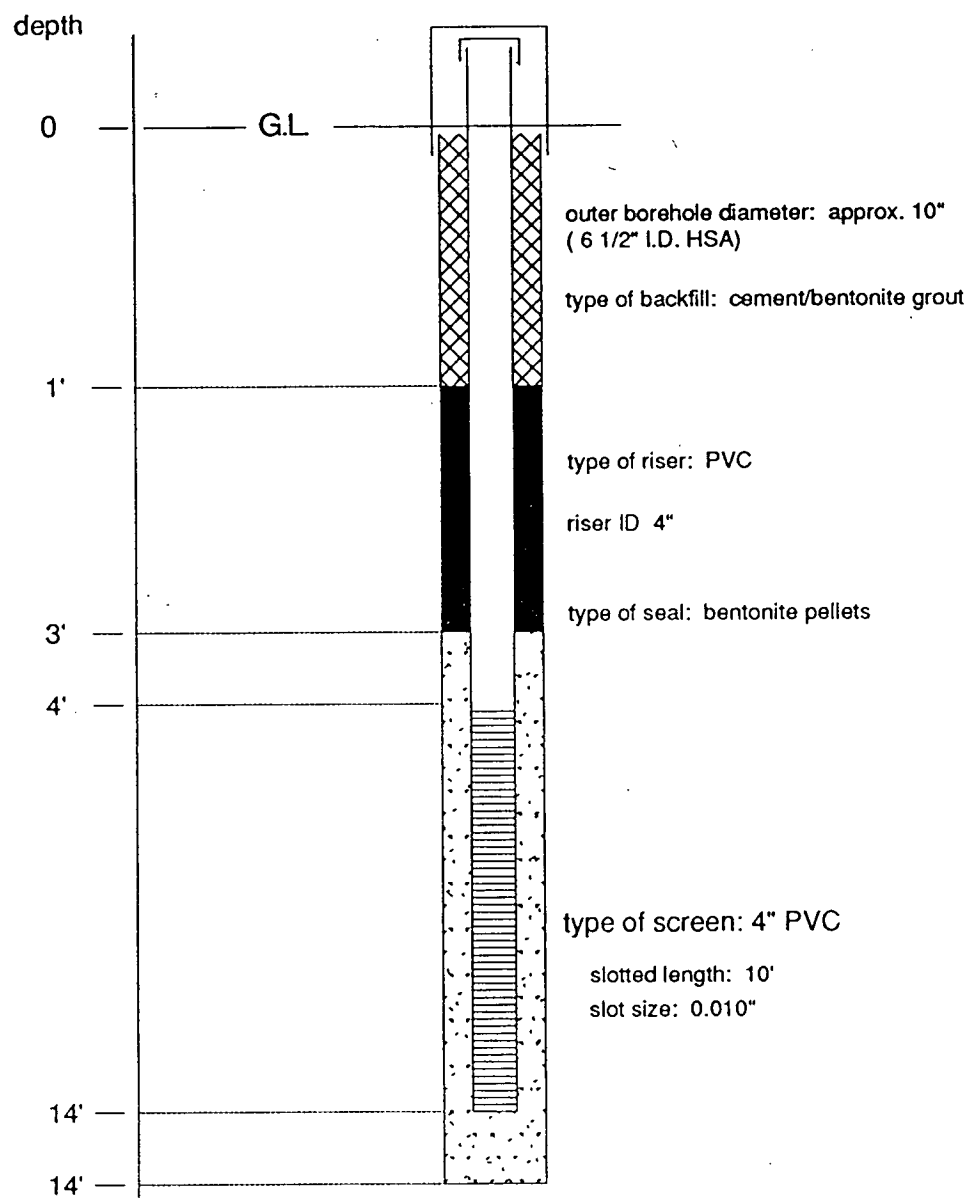
(617) 742-8228

Well Number MW-5

Project Brunswick NAS

Project number 98-65

Date Installed 5/15/92



Appendix B

Analytical Quality Assurance Report

**ANALYTICAL QUALITY ASSURANCE REPORT
THE NAVY EXCHANGE SERVICE STATION
BRUNSWICK NAVAL AIR STATION
SOIL SAMPLES COLLECTED 16 MAY 1992
AND GROUND WATER SAMPLES
COLLECTED 21 MAY 1992**

19 June 1992

Melina A. Williams
Melina A. Williams
Quality Assurance Chemist

David R. Blye
David R. Blye
Quality Assurance Manager

Prepared For:
Department of the Navy, Northern Division
Naval Facilities Engineering Command, Code 023
Building 77L, U.S. Naval Base
Philadelphia, PA 19112

Prepared By:
Environmental Resources Management, Inc.
855 Springdale Drive
Exton, Pennsylvania 19341

File No.: PM425.00.01



TABLE OF CONTENTS

	<u>Page</u>
Section 1 Introduction.....	1-1
Section 2 Organic Data.....	2-1
Section 3 Inorganic and Miscellaneous Data.....	3-1
Section 4 Summary.....	4-1

Attachments

Attachment 1	Methodology Summary/Method References
Attachment 2	Data Summary Tables

LIST OF TABLES

<u>Table</u>	<u>Following</u> <u>Page</u>
1-1	Summary of Sample Data Reviewed..... 1-1

SECTION 1 INTRODUCTION

This analytical quality assurance report is based on the review of analytical data for soil samples collected on 16 May 1992 and ground water samples collected on 21 May 1992 from the Navy Exchange Service Station of the Brunswick Naval Air Station in Brunswick, Maine. The sample locations, collection dates, ERM and laboratory sample identification numbers, and analyses performed are presented in Table 1-1. A summary of the analytical methods and references used to perform the analysis is provided in Attachment 1. Data summary tables presenting the qualified and validated analytical results are included in Attachment 2.

All data for these analyses have been reviewed for adherence to the specified analytical protocols. All results have been validated or qualified according to general guidance provided in the "Laboratory Data Validation Functional Guidelines for Evaluating Organic (and Inorganic) Analyses" (USEPA 2/88 and 7/88).

Table 1-1
Summary of Sample Data Reviewed
Navy Exchange Service Station
Brunswick Naval Air Station
Brunswick, Maine

<u>Sample Location</u>	<u>Collection Date</u>	<u>Laboratory ID Number</u>	<u>Matrix</u>	<u>Analyses Performed</u>
MW-1 (9-10.5')	5/16/92	92137001	Soil	1
MW-2 (7-8.5')	5/16/92	92137002	Soil	1
MW-3 (7-9')	5/16/92	92137003	Soil	1
MW-4 (7-8.5')	5/16/92	92137004	Soil	1
MW-5 (4-6')	5/16/92	92137005	Soil	1
Source Water	5/16/92	92137006	Water	1
Equipment Blank	5/16/92	92137007	Water	2
Trip Blank	5/16/92	92137008	Water	3
MW-1	5/21/92	92142026	Water	1
MW-2	5/21/92	92142027	Water	1
MW-2D	5/21/92	92142032	Water	2
MW-3	5/21/92	92142028	Water	1
MW-4	5/21/92	92142029	Water	1
MW-4D	5/21/92	92142031	Water	4
MW-5	5/21/92	92142030	Water	1
Trip Blank	5/21/92	92142033	Water	3

Analysis Performed:

- 1 - BTEX Analysis (Benzene, Toluene, Ethylbenzene, Xylenes), Lead, Total Petroleum Hydrocarbons (TPH), Methyltertbutyl Ether, Gasoline in Soil, Fuel oil in soil.
- 2 - Lead.
- 3 - BTEX Analysis, Methyltertbutyl Ether.
- 4 - BTEX Analysis, TPH, Methyltertbutyl Ether, Gasoline, Fuel oil.

SECTION 2 ORGANIC DATA

The organic analyses of five ground water samples, five soil samples and their associated travel blanks and equipment blanks were performed by Coast to Coast Analytical Services of Westbrook, Maine. Ground water and soil samples were analyzed for benzene, toluene, ethylbenzene, xylenes, total petroleum hydrocarbons, methyltertbutyl ether, gasoline, and fuel oil as summarized in Table 1-1.

The findings offered in this report are based on a review of the following criteria: chain of custody documentation, holding times, blank analyses, and surrogate compound recoveries

The organic analyses were performed acceptably, based on the criteria evaluated. Therefore, the data can be accepted as quantitatively and qualitatively valid as reported. Results for the samples are provided in the attached sample data summary table.

SECTION 3 INORGANIC DATA

The inorganic analyses of five ground water samples, five soil samples and their associated travel and equipment blanks were performed by Coast to Coast Analytical Services of Westbrook, Maine. Ground water and soil samples were analyzed for lead as specified in Table 1-1. All sample were analyzed according to the US EPA methods presented in Attachment 1.

The findings offered in this report are based upon a review of the following criteria: holding times and blank analyses.

The inorganic analyses were performed acceptably based on the criteria evaluated. Therefore, the data can be accepted as quantitatively and qualitatively valid as reported. Results for the samples are provided in the attached sample data summary tables.

SECTION 4 SUMMARY

The analyses of the soil and ground water samples were performed acceptably. This analytical quality assurance report has identified the aspects of the analytical data which have required qualifying statements. A support documentation package further detailing these findings has been prepared and is filed with the Navy Exchange Service Station, Brunswick, Maine Facility.

ATTACHMENT 1
SUMMARY OF ANALYTICAL
METHODS AND REFERENCES

METHOD SUMMARY AND REFERENCES SOIL SAMPLES

Benzene, Toluene, Ethylbenzene, Xylenes, Methyltertbutyl Ether

Five grams of soil is mixed with 5 mls of dionized water are purged with helium at 40° C and the volatiles are collected on a Tenax/Silica gel trap. The trap is subsequently desorbed onto a gas chromatograph and equipped with a photoionization detector (PID).

Reference: Test Methods for Evaluating Solid Waste, SW-846 Method 8020, Revision 1, December 1987.

Lead

One gram sample aliquots were digested with nitric acid and hydrogen peroxide. The resulting solutions were analyzed by inductively coupled plasma atomic emission (ICP).

Reference: Test Methods for Evaluating Solid Waste, SW-846, Method 3510/6010, September 1986.

Total Petroleum Hydrocarbons

Samples are freon extracted for four hours in a soxhlet apparatus. Petroleum hydrocarbons are then quantitatively measured by Infra Red Spectrophotometry.

Reference: Test methods for Evaluating Solid Waste, SW-846, Method 9071.

Moisture

A well mixed sample is placed in a weighed beaker and dried to constant weight in an oven at 103 to 105°C. The decrease in weight of the sample is proportional to the moisture content.

Reference: Methods for Chemical Analysis of Water and Wastes, US EPA 600/4-79-020, Method 160.3

Gasoline in Soil

Reference: Maine Department of Environmental Protection-LOP 4.2.3.

Fuel Oil in Soil

Reference: Maine Department of Environmental Protection-LOP 4.1.2.

METHOD SUMMARY AND REFERENCES GROUND WATER SAMPLES

Benzene, Toluene, Ethylbenzene, Xylene, Methyltertbutyl Ether

A 5-milliliter sample aliquot was purged with helium at ambient temperature for aqueous volatile organic analyses. Purgeable compounds were transferred from the aqueous to the vapor phase, and trapped onto a sorbent column. After purging, the column was heated and backflushed to desorb the purgeable compounds onto a gas chromatographic column. The gas chromatograph was temperature programmed to separate the sample components, which were then detected with a photolionization detector (PID).

Reference: US EPA 40 CFR Part 136, Appendix A, Method 602.

Lead

One hundred-milliliter sample aliquots were digested with nitric and hydrogen peroxide for analysis by graphite furnace atomic absorption.

Reference: Test Methods for Evaluating Solid Waste, SW-846, September 1986, Method 7421.

Total Petroleum Hydrocarbons

The sample is extracted with freon in a separatory funnel. Petroleum hydrocarbons in the extract are quantitatively measured by Infrared Spectrophotometry.

Reference: Method for Chemical Analysis of Water and Wastes US EPA 600/4-79-020, Method 418.1.

Gasoline in Water

Reference: Maine Department of Environmental Protection-LOP 4.2.1.

Fuel Oil in Water

Reference: Maine Department of Environmental Protection-LOP 4.1.1.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

METHOD REFERENCES

EPA

- "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020.
- "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", EPA-600/4-82-057, July 1982, EMSL Cincinnati, Ohio 45268.
- "Test Methods for Evaluating Solid Waste", EPA-SW-846, November 1986, Third Edition, Office of Solid Waste and Emergency Response, Washington, DC, 20460.
- "Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act", Federal Register Vol. 49, No. 209, October 26, 1984.
- "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water", Physical and Chemical Methods Branch, Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.
- Caucus Organic and Inorganic Protocols, USEPA National Contract Laboratory Program.
- "Determination of Lead Concentration in Ambient Particulate Matter by Inductively Coupled Plasma Optical Emission Spectrometry"(EPA/EMSL/RTP,N.C.)--Approved for Use by EPA,EMSL,RTP,N.C., EQL-0380-045.
- "Reference Method for the Determination of Particulate Matter as TSP in the Atmosphere", 40CFR Part 50 Appendix B.
- "Reference Method for the Determination of Particulate Matter as PM-10 in the Atmosphere", 40CFR Part 50 Appendix J.

SM

- "Standard Methods for the Examination of Water and Wastewater", American Public Health Association, 16th Edition.

Other

- "Method of Soil Analysis; Chemical and Microbiological Properties", Part 2, American Society of Agronomy, C.A. Black, ed., 1965.
- "Official Methods of Analysis of the Association of Official Analytical Chemists", Methods Manual, 14th ed., 1985.
- "Annual Book of ASTM Standards, Volume II (D-19 Water), American Society for Testing and Materials, 1988"

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

ANALYTICAL METHOD INFORMATION
PARAMETER: GASOLINE IN WATER
METHOD: MEDEP-LOP 4.2.1
MATRIX: AQUEOUS

COMPOUND	PQL (mg/L)
Gasoline in Water	0.020

PARAMETER: GASOLINE IN SOIL
METHOD: MEDEP-LOP 4.2.3
MATRIX: SOLID

COMPOUND	PQL (mg/kg drywt)
Gasoline in Soil	5

PARAMETER: FUEL OIL IN WATER
METHOD: MEDEP-LOP 4.1.1
MATRIX: AQUEOUS

COMPOUND	PQL (mg/L)
Fuel Oil in Water	1

PARAMETER: FUEL OIL IN SOIL
METHOD: MEDEP-LOP 4.1.2
MATRIX: SOLID

COMPOUND	PQL (mg/kg drywt.)
Fuel Oil in Soil	30

PQL = Practical Quantitation Limit represents the normally obtainable measurement level achieved by the laboratory under practical and routine laboratory conditions for a variety of sample matrices. Sample-specific reporting limits may vary from the standard PQL as a result of sample matrix and compound concentration.

ATTACHMENT 2
DATA SUMMARY TABLES

Soil Analytical Results
The Navy Exchange Service Station of the Brunswick Naval Air Station
Remedial Investigation
Brunswick, Maine

(All concentrations are reported in µg/kg on a dry weight basis unless otherwise indicated.)

Sample Location	MW-1 (9-10.5')		MW-2 (7-8.5')		MW-3 (7-9')		MW-4 (7-8.5')		MW-5 (4-6')		Source Water		Equipment Blank		Trip Blank	
Sample Date	5/16/92		5/16/92		5/16/92		5/16/92		5/16/92		5/16/92		5/16/92		5/16/92	
Laboratory Number	92137001		92137002		92137003		92137004		92137005		92137006		92137007		92137008	
Matrix	Soil		Soil		Soil		Soil		Soil		water		water		water	
Percent Solids	79		82		83		84		81		NA		NA		NA	
BTEX Analysis											(µg/L)		(µg/L)		(µg/L)	
Toluene	1.3	U	1.2	U	1.2	U	640000		1.2	U	1	U	1	U	1	U
Benzene	1.3	U	1.2	U	1.2	U	5300		1.2	U	1	U	1	U	1	U
Ethylbenzene	1.3	U	1.2	U	1.2	U	340000		1.2	U	1	U	1	U	1	U
Xylenes (total)	2.6	U	2.8	U	2.4	U	1800000		2.4	U	2	I	2	I	2	U
Lead (total) (mg/Kg)	10	U	13		10	U	10	U	20		0.005	U	NA		NA	
Total Petroleum Hydrocarbons (mg/Kg)	10	U	10	U	30		1000		13		1	U	1	U	NA	
Methyltertbutyl Ether	2.6	U	2.4	U	3.6		7300		2.4	U	2	U	2	U	2	U
Gasoline in soil (mg/Kg)	6	U	6	U	6	U	31000		6	U	0.021		NA		NA	
Fuel Oil in soil (mg/kg)	35	U	35	U	35	U	4800		35	U	12		NA		NA	

Qualifiers:

NA - Not Analyzed.

U - This result was analyzed but not detected. The numerical value reported represents the detection limit of the analyte.

**APPROVED FOR
RELEASE BY
QUALITY ASSURANCE**

Daniel R. Bly 6-19-92
QA/QC MANAGER DATE

Ground Water Analytical Results
The Navy Exchange Service Station of the Brunswick Naval Air Station
Remedial Investigation
Brunswick, Maine
(All concentrations are reported in µg/L unless otherwise indicated.)

Sample Location	MW-1	MW-2	MW-2D	MW-3	MW-4	MW-4D	MW-5	Trip Blank
Sample Date	5/21/92	5/21/92	5/21/92	5/21/92	5/21/92	5/21/92	5/21/92	5/21/92
Laboratory Number	92142026	92142027	92142032	92142028	92142029	92142031	92142030	92142033
BTEX Analysis								
Toluene	1.0 U	1.1	NA	4.8	11000	12000	1.0 U	1.0 U
Benzene	1.0 U	1.0 U		14	1000 U	1000	1.0 U	1.0 U
Ethylbenzene	1.0 U	1.0 U		4.8	4000	3900	1.0 U	1.0 U
Xylenes (total)	2.0 U	4.2		23	22000	22000	2.0 U	2.0 U
Dissolved Lead (mg/L)	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	NA	0.005 U	NA
Total Petroleum Hydrocarbons (mg/L)	1.0 U	1.0 U	NA	1.0 U	14	22	1.0 U	NA
Methylterbutyl Ether	2.0 U	2.0 U	NA	2.5	2000 U	2000 U	5.9	2.0 U
Gasoline In Water (mg/L)	0.020 U	0.035	NA	0.02 U	230	210	0.056	NA
Fuel Oil In Water (mg/L)	0.010	0.460	NA	0.061	10	8.4	0.300	NA

Qualifiers:

NA - Not Analyzed.

U - This result was analyzed but not detected. The numerical value reported represents the detection limit of the analyte.

**APPROVED FOR
RELEASE BY
QUALITY ASSURANCE**

David L. Blye 6-17-92
QA/QC MANAGER DATE

Appendix C

Permeability/Slug Test Data

MW-4
rising head

time (min)	value (H-h)	time (min)	value (H-h)
0.00	0.01	1.67	-0.57
0.00	-0.04	1.75	-0.62
0.01	-1.54	1.83	-0.70
0.01	-1.72	1.92	-0.70
0.01	-0.01	2.00	-0.69
0.02	-1.10	2.50	-0.68
0.02	-1.31	3.00	-0.67
0.02	-1.76	3.50	-0.66
0.03	-1.28	4.00	-0.64
0.03	-1.34	4.50	-0.64
0.03	-1.44	5.00	-0.63
0.05	-1.31	5.50	-0.63
0.07	-1.29	6.00	-0.62
0.08	-1.26	6.50	-0.61
0.10	-1.03	7.00	-0.59
0.12	-0.95	7.50	-0.62
0.13	-1.18	8.00	-0.60
0.15	-0.92	8.50	-0.59
0.17	-0.95	9.00	-0.60
0.18	-1.10	9.50	-0.59
0.20	-0.99	10.00	-0.57
0.22	-1.02	12.00	-0.56
0.23	-1.01	14.00	-0.56
0.25	-1.14	16.00	-0.54
0.27	-1.00	18.00	-0.54
0.28	-1.01	20.00	-0.52
0.30	-0.87	22.00	-0.51
0.32	-0.65	24.00	-0.51
0.33	-1.01	26.00	-0.51
0.42	-0.99	28.00	-0.49
0.50	-0.90	30.00	-0.48
0.58	-0.83	32.00	-0.48
0.67	-0.78	34.00	-0.47
0.75	-0.79	36.00	-0.47
0.83	-0.77	38.00	-0.47
0.92	-0.74	40.00	-0.45
1.00	-0.71	42.00	-0.39
1.08	-0.71	44.00	-0.40
1.17	-0.73	46.00	-0.38
1.25	-0.70	48.00	-0.35
1.33	-0.61	50.00	-0.44
1.42	-0.66	52.00	-0.43
1.50	-0.71	54.00	-0.40
1.58	-0.54	56.00	-0.26

MW-5
rising head

time (min)	value (H-h)	time (min)	value (H-h)
0.00	-1.11	1.83	-0.49
0.00	-1.06	1.92	-0.52
0.01	-1.09	2.00	-0.51
0.01	-0.35	2.50	-0.49
0.01	-1.23	3.00	-0.47
0.02	-0.20	3.50	-0.47
0.02	-1.19	4.00	-0.44
0.02	-1.32	4.50	-0.46
0.03	-1.41	5.00	-0.44
0.03	-1.30	5.50	-0.44
0.03	-1.38	6.00	-0.44
0.05	-1.29	6.50	-0.45
0.07	-1.25	7.00	-0.44
0.08	-1.23	7.50	-0.42
0.10	-1.19	8.00	-0.42
0.12	-1.14	8.50	-0.42
0.13	-1.12	9.00	-0.42
0.15	-1.09	9.50	-0.41
0.17	-1.06	10.00	-0.41
0.18	-1.04	12.00	-0.42
0.20	-1.01	14.00	-0.38
0.22	-0.98	16.00	-0.39
0.23	-0.96	18.00	-0.39
0.25	-0.94	20.00	-0.39
0.27	-0.92	22.00	-0.36
0.28	-0.90	24.00	-0.37
0.30	-0.88	26.00	-0.36
0.32	-0.86	28.00	-0.35
0.33	-0.84	30.00	-0.36
0.42	-0.77	32.00	-0.35
0.50	-0.71	34.00	-0.35
0.58	-0.67	36.00	-0.34
0.67	-0.64	38.00	-0.33
0.75	-0.60	40.00	-0.34
0.83	-0.59	42.00	-0.35
0.92	-0.59	44.00	-0.33
1.00	-0.57	46.00	-0.33
1.08	-0.56	48.00	-0.31
1.17	-0.57	50.00	-0.33
1.25	-0.54		
1.33	-0.55		
1.42	-0.52		
1.50	-0.52		
1.58	-0.52		
1.67	-0.52		
1.75	-0.51		

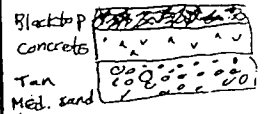
Appendix D

Soil Gas Survey Field Data Sheets

Soil Gas Survey Information

Wileen Curry - Env. Ser.
Office/NAS

General X-sect:



PID used: Photovac PID Microtip
Calibration date: 5/5/92
Calibrated with: 250 ppm isobutylene to read 140.5 ppm equiv. benzene
Field team: CD, JM
Site location: Brunswick NAV
Project number: 98-65
Survey date: 5/5/92
Weather: Overcast, 40° / sunny, breezy 80°

Sample Number	Sample Location	PID Reading Maximum	PPM Stable	Comments
SG-2	106 ft North of SG-17	3.0	1.3	
SG-1	4 ft west of corner of building	3.1	1.9	
(7A) SG-7A	4 ft east of USTs	987.0	105.0	Stable also at 74.5
SG-3	Parallel to Burbank St.	6.1	4.4	
SG-4	Parallel to Burbank St.	9.2	9.2	Possible soil moisture interference
SG-5	3 ft off N. wall / 5 ft in from corner	1.6	1.4	little response
SG-6	3 ft off N. wall	0.1	0.0	no response
(7) SG-7	65 ft north of SG-17	670	245	petroleum odor
SG-8	10 ft south of former waste oil tank	5.0	3.2	S.W. corner of bld.
SG-9	20 ft south of building	6.6	3.5	
SG-10	3 ft south of Bld. / 6 ft in from corner	4.7	2.9	
(17) SG-17	57.8 ft S.E. off corner of Bld.	1211.0	1098.0	Petroleum odor
(13) SG-13	5 ft east of USTs	5.7	5.5	
(12) SG-12	2 ft west of USTs	873.0	810.0	
* SG-14	South side of Burbank St. / under street	0.3	0.6	~1.5 ft deep
SG-15	45 ft South of building	4.4	2.4	
SG-16	21 ft South of SG-10	1079.0	905.0	petroleum odor
(11) SG-11	25 ft west of USTs	1027.0	1003.0	26 ft. North of SG-17
* SG-18	South side of Burbank St. / 20' South of St. edge.	0.8	0.6	~1.5 feet deep
* SG-19	South side Burbank St. / Eastern end RSL Run	1.3	0.3	~1.5 " "
SG-20	near recovery system	2.3	1.5	
(8A) SG-8A	near former waste oil tank	7.1	2.0	

blacktop.
grass
987 530
0.0 76. blackt
grass
grass
grass
grass
blacktop
blacktop
blacktop
blacktop
blacktop
grass
blacktop
grass
blacktop
grass island
blacktop

FSP

revised 4/12/91
215-02-03

* Measurement recorded 5/6

Figure 5-1 - Soil Gas Survey Data Sheet



Soil Gas Survey Information

PID used: Photovac Microtip PID	Site location: Brunswick NAS
Calibration date: 5/5/92	Project number: 98-65
Calibrated with: 250 isobutylene to 140.5 ppm benzene equiv.	Survey date: 5/5/92
Field team: CD, JM	Weather: Overcast 35°

SG-22A (5 ft east of)
Near pump island

14.8

4.9

blacktop

Sample Number	Sample Location	PID Reading		Comments
		Maximum	Stable	
SG-21	near recovery system	2.0	1.9	
SG-22	near recovery system	2.6	2.5	
SG-23	42 ft South of SG-10	401.0	89.3	5 ft in from Burbank st.
SG-24	North of Family Serv. Center	1.5/3.6*	1.3/3.4*	~1.5 ft deep
* SG-25	Center of FSC Front Lawn	1.3	1.2	~1.5 ft deep
* SG-26	FSC Lawn - near Transformer	2.9	2.8	~1.5 ft deep
* SG-27	West side of 2nd St.	0.7	0.4	~2 ft. boring
(29) SG-28	near recovery system	2.1	1.3	
(28) SG-28	near recovery system	1.4	1.3	
SG-30	near recovery system	3.6	3.3	petroleum odor
SG-31	West of Family Serv. Center	1.9/0.7*	0.6/0.6*	shallow 1.5'
* (39) SG-32	Rear of FSC	0.5	0.4	2 ft deep - wet soil
* SG-33	Adjacent to FSC Building	3.0	2.9	shallow ~1.5'
* SG-34	Adjacent to FSC Building	0.4	0.2	~ 2.5 feet deep
* SG-35	Along Burbank - North side - 20 ft west of sign post	1.7	0.4	~ 2 ft. boring
* SG-36	Corner of 2nd & Burbank 20' west of street sign	0.0	0.0	shallow 1.5'
SG-37	West of Family Serv. Center	0.6	0.3	2-3 ft
SG-38	West of Family Serv. Center	0.3	0.2	2-3 ft
(32) SG-39	West 4 ft off Family Serv. Center	1.1	1.1	2-3 ft
SG-40	Rear of FSC	0.4	0.1	2 ft

grass island

grass island

blacktop

grass

grass

grass

grass

grass island

grass island

grass island

grass

grass

grass

grass/sand-fill

grass

grass

grass

grass

grass

grass
wet soil
from cuttings

Page 2 of on 5/5

FSP
revised 4/12/91
215-02-03

* Measurement recorded 5/6

Figure 5-1 - Soil Gas Survey Data Sheet



Soil Gas Survey Information

PID used: Photovac PID	Site location: Brunswick NAS
Calibration date: 5/5/92 3rd calib. 4:00 PM	Project number: 98-65
Calibrated with: 250 isobutylene → 140.5 ppm benzene	Survey date: 5/5/92
Field team: CD, JM	Weather: Overcast 35°

Sample Number	Sample Location	PID Reading		Comments
		Maximum	Stable	
SG-41	Rear of FSC - Center	1.0	0.8	wet soils from cuttings ~ 2 ft deep grass
SG-42	End end and at the rear of the FSC	0.2	0.0	~ 1.5 ft deep wet soils grass
SG-43	S.W. of Burbank St.	2.9	2.5	~ 1.5 ft deep grass
SG-44	S.W. of Burbank St.	0.9	0.8	~ 1.5 ft deep grass
* SG-45	W side of 2nd St.	0.9	0.8	~ 2.0 ft deep grass
* SG-46	W. side of 2nd St.	0.7	0.6	~ 2.0 ft. deep parking area pavement
SG-47				
SG-48				
SG-49				
SG-50				
(43A) SG-43A	S.W. of Burbank St.	1.9	1.3	~ 1.5 ft deep grass
(31A) SG-31A	South Side of Burbank St. 20' west of E. side of sidewalk	1.2	0.8	~ 1.5 ft deep side with pavement
(18A) SG-18A	South side of Burbank St.	4.9	1.2	~ 1.5 ft deep grass
* SG-19A	" " " " " " FSC East lawn	10.8	0.8	~ 2.0 ft deep grass 33' north of west pipe
* SG-34A	Adjacent to west pipe along Northern side of FSC	2.6	2.1	~ 2.0 ft deep grass - possible influence of soil venting system along 18A, 19A, 34A
* SG-32A	North side of FSC 5 ft off Blvd.	2.8	2.6	~ 2.0 ft deep grass
* SG-16A	East of Pump Island by ~ 2 ft	1.5	1.3	~ 2.0 ft deep black-top
* SG-3A	East of UST by ~ 4 ft	0.6	0.5	~ 2.5 ft deep grass

Page 3 of - on 5/5

FSP

revised 4/12/91

215-02-03

* Measurement recorded 5/6

Figure 5-1 - Soil Gas Survey Data Sheet



Appendix E

Laboratory Reports

COAST-TO-COAST ANALYTICAL SVCS
NORTHEASTERN REGION
340 COUNTY ROAD NO. 5
P. O. BOX 720
WESTBROOK, ME 04092
(207)874-2400/FAX(207)775-4029

ERM - NEW ENGLAND, INC.
95 INDIA STREET
PORTLAND, ME 04101

REPORT OF ANALYSIS 6/08/92
REFERENCE NUMBER 12869
PAGE 1

CLIENT SAMPLE ID
CCAS SAMPLE ID
DATE RECEIVED

MW1
92142020
5/21/92

MW2
92142021
5/21/92

MW3
92142022
5/21/92

MW4
92142023
5/21/92

UNITS

FUEL OIL IN WATER

FUEL OIL IN WATER

10

460

61

100000

UG/L

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

LEVEL I+ REPORT

Level I+ documentation consists of the following components for specific types of analyses:

Section	Type of Documentation
INORGANIC ANALYSES FOR METALS	
	o METHODS AND CHRONOLOGY OF ANALYSIS
	o METHOD BLANK RESULTS
INORGANIC ANALYSES FOR NON-METALS	
	o METHODS AND CHRONOLOGY OF ANALYSIS
	o METHOD BLANK RESULTS
ORGANIC ANALYSES BY GC	
	o METHODS, CHRONOLOGY OF ANALYSIS AND METHOD BLANK RESULTS
CHAIN OF CUSTODY	
	o ANALYSIS REQUEST FORMS
	o CHAIN OF CUSTODY RECORDS
	o CORRESPONDENCE

000002

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

Methods and Chronology of Analysis

METHODS OF ANALYSIS			CHRONOLOGY OF ANALYSES				
Parameter	Method No.	Description	CCAS Sample Nos.	Date Sample Received	Date of Sample Chemical Preparation	Date of Instrument Analysis	Dilution Factor *
Lead	239.2	Atomic Absorption, Graphite Furnace	92142026	21-May-92	26-May-92	28-May-92	1.0
			92142027	21-May-92	26-May-92	28-May-92	1.0
			92142028	21-May-92	26-May-92	26-May-92	1.0
			92142029	21-May-92	26-May-92	26-May-92	1.0
			92142030	21-May-92	26-May-92	26-May-92	1.0
			92142032	21-May-92	26-May-92	26-May-92	1.0

Notes:

Unless otherwise indicated, analytical methods are from (1) "Methods of Chemical Analysis of Water and Wastes," EPA-600/4-79-020, Revised March, 1983, or (2) "Test Methods for Evaluating Solid Wastes," EPA SW-846, Revised November, 1986.

*The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

000003

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

Method Blank and Laboratory Control Sample Results

METHOD BLANK RESULTS							LABORATORY CONTROL SAMPLE RESULTS					
Parameter	Date of Prep	Date of Analysis	Concentration		Acceptance Range	Practical Quantitation Level*	Units	True Value	Measured Value	Percent Recovered	Acceptance Range (%)	Acceptance Range (mg/kg)
			Units	Measured in Blank								
Lead	26-May-92	28-May-92	mg/L	< 0.005	< 0.005	0.005						
	26-May-92	28-May-92	mg/L	< 0.005	< 0.005	0.005						

* Practical quantitation level is the lowest concentration measurable for samples with normal chemical and physical composition during routine laboratory operations.

DATA QUALITY COMMENTS:

Results of all quality control measurements are within the laboratory and method specified acceptance range except as noted.

11000000

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

Methods and Chronology of Analysis

METHODS OF ANALYSIS			CHRONOLOGY OF ANALYSES				
Parameter	Method No.	Description	CCAS Sample Nos.	Date Sample Received	Date of Sample Chemical Preparation	Date of Instrument Analysis	Dilution Factor *
Total Petroleum Hydrocarbons	418.1	Spectrophotometric, Infrared	92142026	21-May-92	05-Jun-92	05-Jun-92	1.0
			92142027	21-May-92	05-Jun-92	05-Jun-92	1.0
			92142028	21-May-92	05-Jun-92	05-Jun-92	1.0
			92142029	21-May-92	05-Jun-92	05-Jun-92	1.0
			92142030	21-May-92	05-Jun-92	05-Jun-92	1.0
			92142031	21-May-92	05-Jun-92	05-Jun-92	1.0

Notes:

Unless otherwise indicated, analytical methods are from (1) "Methods of Chemical Analysis of Water and Wastes," EPA 600/4-79-020, Revised March, 1983, or (2) "Test Methods for Evaluating Solid Wastes," EPA SW-846, Revised November, 1986.

*The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

000005

000007

Water Matrix

[illegible][illegible]

The remaining compounds were below the Laboratory Practical Quantitation limits.

000009

Water Matrix

[illegible]

Compound	Conc. (ug/L)

~ The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

Methods, Chronology of Analysis and Method Blank Results

000014

Volatile Organics by GC Method 602 & MTBE

Water Matrix

CHRONOLOGY

[illegible]

METHOD BLANK RESULTS*

Compound	Conc. (ug/L)

* Only positive hits have been included. The remaining compounds were below the laboratory Practical Quantitation Limits.

~ The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

SAMPLE CHAIN OF CUSTODY

ERM- NEW ENGLAND, INC
205 Portland Street, Boston MA 02114
(617)742-8228 FAX (617)720-5742

Project # <u>SOS-10</u>			Project Name <u>NAS Brunswick</u>			Number of Containers	DEP <u>Fug</u> 0.1						Airbill #
Sampler <u>MA</u>			ERM Contact <u>Mark Arienti</u>										Remarks
ERM Traffic Report	Date	Time	Comp or Grab (C or G)	Sample Matrix	Station Location								
	<u>5/21</u>		<u>G</u>	<u>W</u>	<u>MW-1</u>	<u>2</u>	<u>2</u>						
	<u>"</u>		<u>"</u>	<u>"</u>	<u>MW-2</u>	<u>2</u>	<u>2</u>						
	<u>"</u>		<u>"</u>	<u>"</u>	<u>MW-3</u>	<u>2</u>	<u>2</u>						
	<u>"</u>		<u>"</u>	<u>"</u>	<u>MW-4</u>	<u>2</u>	<u>2</u>						
	<u>"</u>		<u>"</u>	<u>"</u>	<u>MW-4D</u>	<u>2</u>	<u>2</u>						
	<u>"</u>		<u>"</u>	<u>"</u>	<u>MW-5</u>	<u>2</u>	<u>2</u>						
	<u>"</u>												
	<u>"</u>												
	<u>"</u>												
	<u>"</u>												
	<u>"</u>												
Sample Relinquished by <u>MA</u>			Sample Received by <u>John L. Shields</u>			Date <u>5/21</u>		Time <u>9:00 PM</u>		Reason for Transfer <u>TO LAB</u>			

COPIES, White-Sampler, Yellow-Lab, Pink-Client, Gold-File

0000

ERM- NEW ENGLAND, INC

205 Portland Street, Boston MA 02114
(617)742-8228 FAX (617)720-5742

SAMPLE CHAIN OF CUSTODY

Project # <u>SOS-10</u>			Project Name <u>Brunswick NEX</u>			Number of Containers	TPH	Lead	BTEX + MTBE	Gasoline	Airbill #	Remarks
Sampler <u>MA</u>			ERM Contact <u>Mark Aronoff</u>									
ERM Traffic Report	Date	Time	Comp or Grab (C or G)	Sample Matrix	Station Location							
	5/21		G	W	MW-1	6	1	1	2	2		
					MW-2	6	1	1	2	2		
					MW-2D	1		1				
					MW-3	6	1	1	2	2		
					MW-4	6	1	1	2	2		
					MW-4D	5	1		2	2		
					MW-5	6	1	1	2	2		
Sample Relinquished by <u>[Signature]</u>			Sample Received by <u>John Shields</u>			Date <u>5/21</u>		Time <u>4:00</u>		Reason for Transfer <u>TO LAB</u>		

000015

COPIES, White-Sampler, Yellow-Lab, Pink-Client, Gold-File

Client: ERM-New England, Sample. Nos.: 92137001-92137008

000001

ANALYSIS AND QUALITY CONTROL
DOCUMENTATION

Prepared By:

COAST-TO-COAST ANALYTICAL SERVICES, INC.
NORTHEASTERN DIVISION

02-Jun-92

Reviewed and Approved by: Carol Ann
Laboratory Quality Assurance

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

000002

LEVEL I+ REPORT

Level I+ documentation consists of the following components for specific types of analyses:

Section	Type of Documentation
INORGANIC ANALYSES FOR METALS	
	o METHODS AND CHRONOLOGY OF ANALYSIS
	o METHOD BLANK RESULTS
INORGANIC ANALYSES FOR NON-METALS	
	o METHODS AND CHRONOLOGY OF ANALYSIS
	o METHOD BLANK RESULTS
ORGANIC ANALYSES BY GC	
	o METHODS, CHRONOLOGY OF ANALYSIS AND METHOD BLANK RESULTS
CHAIN OF CUSTODY	
	o ANALYSIS REQUEST FORMS
	o CHAIN OF CUSTODY RECORDS
	o CORRESPONDENCE

Coast-To-Coast Analytical Services, Inc.

Northeastern Division

Quality Control Report

000003

Methods and Chronology of Analysis

METHODS OF ANALYSIS

CHRONOLOGY OF ANALYSES

Parameter	Method No.	Description	CCAS Sample Nos.	Date Sample Received	Date of Sample Chemical Preparation	Date of Instrument Analysis	Dilution Factor *
Lead	239.2	Atomic Absorption, Graphite Furnace	92137006	16-May-92	27-May-92	28-May-92	1.0
Lead	6010	Atomic Emission, Inductively Coupled Plasma	92137001	16-May-92	27-May-92	28-May-92	1.0
			92137002	16-May-92	27-May-92	28-May-92	1.0
			92137003	16-May-92	27-May-92	28-May-92	1.0
			92137004	16-May-92	27-May-92	28-May-92	1.0
			92137005	16-May-92	27-May-92	28-May-92	1.0

Notes:

Unless otherwise indicated, analytical methods are from (1) "Methods of Chemical Analysis of Water and Wastes," EPA-600/4-79-020, Revised March, 1983, or (2) "Test Methods for Evaluating Solid Wastes," EPA SW-846, Revised November, 1986.

*The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

000004

Method Blank and Laboratory Control Sample Results

METHOD BLANK RESULTS							LABORATORY CONTROL SAMPLE RESULTS					
Parameter	Date of Prep	Date of Analysis	Concentration		Practical Quantitation Level*	Measured		Percent Recovered	Acceptance Range (%)	Acceptance Range (mg/kg)		
			Units	Measured in Blank		True Value	Value					
Lead	27-May-92	29-May-92	mg/L	< 0.005	< 0.005	0.005						
	27-May-92	28-May-92	mg/L	< 0.005	< 0.005	0.005						
Lead	27-May-92	28-May-92	mg/L	< 0.10	< 0.10	0.10						
	27-May-92	28-May-92	mg/L	< 0.10	< 0.10	0.10						

* Practical quantitation level is the lowest concentration measurable for samples with normal chemical and physical composition during routine laboratory operations.

DATA QUALITY COMMENTS:

Results of all quality control measurements are within the laboratory and method specified acceptance range except as noted.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

000001

Methods and Chronology of Analysis

METHODS OF ANALYSIS

CHRONOLOGY OF ANALYSES

Parameter	Method No.	Description	CCAS Sample Nos.	Date Sample Received	Date of Sample Chemical Preparation	Date of Instrument Analysis	Dilution Factor *
Total Petroleum Hydrocarbons	418.1	Spectrophotometric, Infrared	92137006	16-May-92	29-May-92	29-May-92	1.0
			92137007	16-May-92	29-May-92	29-May-92	1.0
Total Petroleum Hydrocarbons	9071/418.1	Soxhlet Extraction/Spectrophotometric, IR	92137001	16-May-92	21-May-92	29-May-92	1.0
			92137002	16-May-92	21-May-92	29-May-92	1.0
			92137003	16-May-92	21-May-92	29-May-92	1.0
			92137004	16-May-92	21-May-92	29-May-92	1.0
			92137005	16-May-92	21-May-92	29-May-92	1.0
TS -Total Residue	CLP-CIP	Gravimetric, 103-105C	92137001	16-May-92	19-May-92	20-May-92	1.0
			92137002	16-May-92	19-May-92	20-May-92	1.0
			92137003	16-May-92	19-May-92	20-May-92	1.0
			92137004	16-May-92	19-May-92	20-May-92	1.0
			92134005	16-May-92	19-May-92	20-May-92	1.0

Notes:

Unless otherwise indicated, analytical methods are from (1) "Methods of Chemical Analysis of Water and Wastes," EPA 600/4-79-020, Revised March, 1983, or (2) "Test Methods for Evaluating Solid Wastes," EPA SW-846, Revised November, 1986.

CLP-CIP = USEPA Contract Laboratory Program Caucus Inorganic Protocols, SOW 0788.

*The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

Client: ERM-New England

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

000006

Method Blank and Laboratory Control Sample Results

METHOD BLANK RESULTS

LABORATORY CONTROL SAMPLE RESULTS

Parameter	Date of Prep*	Date of Analysis*	Units	Conc. Measured in Blank	Acceptance Range	Practical Quantitation Level**	Units	True Value	Measured Value	Percent Recovered	Acceptance Range (%)	Acceptance Range (mg/kg)	Acceptance Range (%)
Total Petroleum Hydrocarbon	29-May-92	29-May-92	mg/L	< 1.0	< 1.0	1.0							
TS -Total Residue	19-May-92	20-May-92	wt %	< 0.10	< 0.10	0.10							
Total Petroleum Hydrocarbon	21-May-92	29-May-92	mg/kg	< 10	< 10	10							
	21-May-92	29-May-92	mg/kg	< 10	< 10	10							

* Date is indicated if sample preparation/analysis was performed on more than one day for a parameter. If no date is given, all samples, method blanks and laboratory control samples were prepared and analyzed as indicated on the Chronology Form.

** Practical quantitation level is the lowest concentration measurable for samples with normal chemical and physical composition during routine laboratory operations.

DATA QUALITY COMMENTS:

Results of all quality control measurements are within the laboratory and method specified acceptance range except as noted.

000007

Gasoline by GC

Water Matrix

[illegible][illegible]

The remaining compounds were below the Laboratory Practical Quantitation limits.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

Methods, Chronology of Analysis and Method Blank Results

Gasoline by GC

Soil/Solid Matrix

CHRONOLOGY

CCAS Sample Nos.	Date Received	Date Extracted	Date Analyzed		CCAS Sample Nos.	Date Received	Date Extracted	Date Analyzed
92137001	16-May-92	NA	22-May-92					
92137002	16-May-92	NA	22-May-92					
92137003	16-May-92	NA	22-May-92					
92137004	16-May-92	NA	22-May-92					
92137005	16-May-92	NA	22-May-92					

METHOD BLANK RESULTS*

Compound	Conc. (mg/kg)

- * Only positive hits have been included.
The remaining compounds were below the laboratory Practical Quantitation limits.

800000

00000

Fuel Oil by GC

Water Matrix

CHRONOLOGY

[illegible]

METHOD BLANK RESULTS*

[illegible]

* Only positive hits have been included.

The remaining compounds were below the Laboratory Practical Quantitation limits.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

000010

Methods, Chronology of Analysis and Method Blank Results

Fuel Oil by GC

Soil/Solid Matrix

CHRONOLOGY

CCAS Sample Nos.	Date Received	Date Extracted	Date Analyzed		CCAS Sample Nos.	Date Received	Date Extracted	Date Analyzed
92137001	16-May-92	22-May-92	26-May-92					
92137002	16-May-92	22-May-92	26-May-92					
92137003	16-May-92	22-May-92	26-May-92					
92137004	16-May-92	22-May-92	27-May-92					
92137005	16-May-92	22-May-92	26-May-92					

METHOD BLANK RESULTS*

Compound	Conc. (mg/kg)

- * Only positive hits have been included.
The remaining compounds were below the laboratory Practical Quantitation limits.

000011

Volatile Organics by GC Method 602/MTBE

CHRONOLOGY

[illegible]

METHOD BLANK RESULTS*

Compound	Conc. (ug/kg)
Benzene	1.2

* Only positive hits have been included. The remaining compounds were below the laboratory Practical Quantitation Limits.

~ The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

000012

Methods, Chronology of Analysis and Method Blank Results

Volatile Organics by GC Method 602/MTBE

Soil/Solid Matrix

CHRONOLOGY

CCAS Sample Nos.	Date Received	Date Analyzed	Dilution Factor~	CCAS Sample Nos.	Date Received	Date Analyzed	Dilution Factor~
92137004	16-May-92	28-May-92	2500				

METHOD BLANK RESULTS*

Compound	Conc. (ug/kg)

* Only positive hits have been included. The remaining compounds were below the laboratory Practical Quantitation Limits.

~ The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Quality Control Report

000013

Methods, Chronology of Analysis and Method Blank Results

Volatile Organics by GC Method 602/MTBE

Water Matrix

CHRONOLOGY

CCAS Sample Nos.	Date Received	Date Analyzed	Dilution Factor~	CCAS Sample Nos.	Date Received	Date Analyzed	Dilution Factor~
92137006	16-May-92	18-May-92	1.0				
92137007	16-May-92	18-May-92	1.0				
92137008	16-May-92	18-May-92	1.0				

METHOD BLANK RESULTS*

Compound	Conc. (ug/L)

* Only positive hits have been included. The remaining compounds were below the laboratory Practical Quantitation Limits.

~ The Dilution Factor (DF) indicates whether a sample, prepared in accordance with the analytical method protocol, was diluted prior to analysis. The Dilution Factor could also indicate that a smaller aliquot than specified in the method was utilized for sample preparation and analysis. For example, a dilution factor of 5 means that the sample was effectively diluted by a factor of 5 prior to analysis, i.e., the sample was analyzed at 20% its reported concentration.



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Northeastern Division
340 County Road, No. 5 • P.O. Box 720 • Westbrook, ME 04098

(207) 874-2400
Fax (207) 775-4029

July 15, 1992

Mr. Rob Stockwell
ERM - New England, Inc.
95 India Street
Portland, ME 04101

Dear Mr. Stockwell:

The table below summarizes the reanalysis of chromatograms for the following sample numbers received by the Coast-to-Coast Analytical Services Laboratory on May 16, 1992.

<u>CCAS Sample ID</u>	<u>Result</u>	<u>Unit</u>
92137001	< 10	mg/kgdrywt
92137002	< 10	mg/kgdrywt
92137003	< 10	mg/kgdrywt
92137004	4800	mg/kgdrywt
92137005	< 10	mg/kgdrywt

Please replace these results with the results reported on the June 2, 1992; report reference number 12844. As I explained, due to CCAS's new reporting system, we are unable to reissue the original report under the original reporting format.

We apologize for any inconvenience this may have caused. If you have any other questions, please do not hesitate to contact me.

Sincerely,

Coast-to-Coast Analytical Services, Inc.

Geoffrey D. Pellechia

Geoffrey D. Pellechia
Client Services Representative

cc: W.C. Warren
L.J. O'Meara

Portland Office Tel. # (207) 761-3928

ERM- NEW ENGLAND, INC

205 Portland Street, Boston MA 02114

(617) 742-8228 FAX (617) 720-5742

SAMPLE CHAIN OF CUSTODY

Project # 98-65			Project Name Brunswick NAS			Number of Containers	BTX+MTBE EPA 8020	TOTAL LEAD EPA 7421	GASOLINE ME DEP 4.2.3	FUEL OIL ME DEP 4.1.2	TPH EPA 418.1	Airbill # 000015
Sampler CD			ERM Contact Rob Stockwell									Remarks
ERM Traffic Report	Date	Time	Comp or Grab (C or G)	Sample Matrix	Station Location							
	5/14	11:00	G	Soil	MW-1, 9-10.5'	5	X	X	X	X	X	98-65-01
	5/14	2200	G	Soil	MW-4, 7-8.5'	5	X	X	X	X	X	98-65-04
	5/15	9:00	G	Soil	*MW-2, 7-8.5'	5	X	X	X	X	X	98-65-02
	5/15	-	G	Water	Trip Blank	2	X					98-65-14 (from lab)
	5/15	9:00	G	Water	Source Water	8	X	X	X	X	X	98-65-06
	5/15	11:00	G	Soil	MW-3, 7-9'	5	X	X	X	X	X	98-65-03
	5/15	1:00	G	Water	Equipment Blank	3	X				X	98-65-13
	5/15	3:00	G	Soil	MW-5, 4-6'	5	X	X	X	X	X	98-65-05
Sample Relinquished by			Sample Received by			Date	Time		Reason for Transfer			
Charles J. Leger			Robert Stockwell			5/15/92			TO LAB			
			Jeffrey D. Pellechia			05/16/92	9:45					

COPIES, White-Sampler, Yellow-Lab, Pink-Client, Gold-File

COAST-TO-COAST ANALYTICAL SVCS
NORTHEASTERN REGION
340 COUNTY ROAD NO. 5
P. O. BOX 720
WESTBROOK, ME 04092
(207)874-2400/FAX(207)775-4029

ERM - NEW ENGLAND, INC.
95 INDIA STREET
PORTLAND, ME 04101

REPORT OF ANALYSIS 6/02/92
REFERENCE NUMBER 12844
PAGE 1

CLIENT SAMPLE ID
CCAS SAMPLE ID
DATE RECEIVED

MW-1
92137001
5/16/92
< 79
< 10
< 10

MW-2
92137002
5/16/92
< 82
< 13
< 10

MW-3
92137003
5/16/92
< 83
< 10
< 30

MW-4
92137004
5/16/92
< 84
< 10
* 1000

UNITS
MGS/KG DRY WT
MGS/KG DRY WT
MGS/KG DRY WT

RESIDUE, TOTAL (TS)
LEAD, TOTAL
TOTAL PETROLEUM HYDROCARBONS

BTX ANALYSIS

TOLUENE
BENZENE
ETHYLBENZENE
TOTAL XYLENES

< 1.3
< 1.3
< 1.3
< 2.6

< 1.2
< 1.2
< 1.2
< 2.8

< 1.2
< 1.2
< 1.2
< 2.4

640000
5300
340000
1800000

UG/KG DRY WT
UG/KG DRY WT
UG/KG DRY WT
UG/KG DRY WT

MTBE ANALYSIS

METHYLTERTBUTYL ETHER

< 2.6
< 2.4

< 2.4

3.6

7300

UG/KG DRY WT

PURGEABLE AROMATICS SURROGATE RECOVERY

4-BROMOFLUOROBENZENE

80

69

83

85

X

GASOLINE IN SOIL

GASOLINE IN SOIL

< 6
< 6

< 6

< 6

31000

MG/KG DRY WT

FUEL OIL IN SOIL

FUEL OIL IN SOIL

< 35
< 35

< 35

< 35

4800

MG/KG DRY WT

ERM - NEW ENGLAND, INC.
95 INDIA STREET
PORTLAND, ME 04101

REPORT OF ANALYSIS 6/02/92
REFERENCE NUMBER 12844
PAGE 2

CLIENT SAMPLE ID MW-5
CCAS SAMPLE ID 92137005
DATE RECEIVED 5/16/92

RESIDUE, TOTAL (TS) 81
LEAD, TOTAL 20
TOTAL PETROLEUM HYDROCARBONS 13

UNITS
WT %
MG/KG DRY WT
MG/KG DRY WT

BTEX ANALYSIS

TOLUENE < 1.2
BENZENE < 1.2
ETHYLBENZENE < 1.2
TOTAL XYLENES < 2.4

UG/KG DRY WT
UG/KG DRY WT
UG/KG DRY WT
UG/KG DRY WT

MTBE ANALYSIS

METHYL TERT BUTYL ETHER < 2.4

UG/KG DRY WT

PURGEABLE AROMATICS SURROGATE RECOVERY

4-BROMOFLUOROBENZENE 68

X

GASOLINE IN SOIL

GASOLINE IN SOIL < 6

MG/KG DRY WT

FUEL OIL IN SOIL

FUEL OIL IN SOIL < 35

MG/KG DRY WT

ERM - NEW ENGLAND, INC.
95 INDIA STREET
PORTLAND, ME 04101

REPORT OF ANALYSIS
REFERENCE NUMBER
PAGE

6/02/92
12844
3

	CLIENT SAMPLE ID	WATER	EQUIP.	TRIP BLK	UNITS
	CCAS SAMPLE ID	92137006	92137007	92137008	
	DATE RECEIVED	5/16/92	5/16/92	5/16/92	
LEAD, TOTAL		< 0.005			MG/L
TOTAL PETROLEUM HYDROCARBONS		< 1.0	< 1.0		MG/L

BTX ANALYSIS

TOLUENE	< 1	< 1	< 1	UG/L
BENZENE	< 1	< 1	< 1	UG/L
ETHYLBENZENE	< 1	< 1	< 1	UG/L
TOTAL XYLENES	< 2	< 2	< 2	UG/L

MTBE ANALYSIS

METHYLTERTBUTYL ETHER	< 2	< 2	< 2	UG/L
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PURGEABLE AROMATICS SURROGATE RECOVERY

4-BROMOFLUOROBENZENE	128	122	121	X
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GASOLINE IN WATER

GASOLINE IN WATER	0.021	—	—	MG/L
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FUEL OIL IN WATER

FUEL OIL IN WATER	12	—	—	UG/L
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SIGNATURE
RELEASED BY
CLIENT AUTHORIZATION

Laura J O'Meara
LAURA J O'MEARA
98-65

ERM - NEW ENGLAND, INC.
95 INDIA STREET
PORTLAND, ME 04101

REPORT OF ANALYSIS
REFERENCE NUMBER
PAGE

6/02/92
12844
4

Duplicate analyses (1000 mg/kgdrywt, 690 mg/kgdrywt) were performed on this sample for this parameter. The precision of the duplicate results is outside the laboratory's acceptance range. Sample homogeneity may be a factor.

For the BTEX and MTBE analysis of sample number 92137004:

Sample dilution required for quantitation of one or more target analytes; therefore, standard laboratory Practical Quantitation Level (PQL) could not be achieved.

Coast-To-Coast Analytical Services, Inc.
 Northeast Division
 Westbrook, Maine

GENERAL CHEMICAL ANALYSES - SOLID MATRIX

PARAMETER	METHOD	PQL
% Carbon	ASTM	wt. %
Chloride-Automated Ferricyanide	ASTM D3987/9251	40 mg/kg
Corrosivity-NACE Standard TM-01-69	1110	10 mpy
Cyanide, Total-Spectrophotometric	APHA 412/9010	2 mg/kg
Cyanide, Amenable-Spectrophotometric	APHA 412/9010	2 mg/kg
Fluoride, Potentiometric ISE	ASTM D3987/340.2	4 mg/kg
Ignitability-Flash Point (closed cup)	1010	25 Degrees Celsius
Ammonia-Nitrogen-Automated Phenate	APHA 420A/350.1	8 mg/kg
Organic Nitrogen-Auto. Block Digest., Spectro.	APHA 420A/350.1/351.2	40 mg/kg
Total Kjeldahl Nitrogen-Auto Block Digest, Spectro.	APHA 420A/351.2	40 mg/kg
Nitrate+Nitrite-Automated Cadmium Reduction	ASTM D3987/353.2	40 mg/kg
Nitrate-Automated Cadmium Red./Diazotization	ASTM D3987/353.2/354.1	1 mg/kg
Nitrite-Automated Diazotization	ASTM D3987/354.1	1 mg/kg
Oil & Grease-Total Recoverable, Gravimetric	9071	0.025 wt. %
Oil & Grease-Total Recoverable, Infrared	9071/413.2	15 mg/kg
Oil & Grease-Hydrocarbons, Grav./Solvent Extract	APHA 503E/503C	0.025 wt. %
pH (Laboratory)	9045	
Phenolics, Total Recoverable-Manual 4AAP	Mod. 9065	0.5 mg/kg
Phosphate, Total-Auto Ascorbic Acid/Block Digestion	Mod. 365.4	25 mg/kg
Phosphate, Ortho-Auto. Ascorbic Acid	ASTM D3987/365.1	1 mg/kg
Solids-Total Solids (TS)	CLP-CIP	0.1 wt. %
Solids-Ash	APHA 209F	0.1 wt. %
Solids-Volatile Solids	APHA 209F	0.1 wt. %
Specific Conductance-Wheatstone Bridge	ASTM D3987/9050	umhos/cm
Sulfate-Turbidimetric	ASTM D3987/9038	20 mg/kg
Sulfide-Monier-Williams	40CFR-425	4 mg/kg
Sulfide-Reactive	7.3.4.1	27 mg/kg
Total Organic Halogen	ASTM	ppm
Total Petroleum Hydrocarbons-Extraction, IR	9071/418.1	10 mg/kg
Cation Exchange Capacity	9081	meq/100g
Heat of Combustion (BTU)	ASTM D240/D2382	BTU/lb
Lime Equivalency	Special Procedure	wt. %

PQL = Practical Quantitation Limit represents the normally obtainable measurement level achieved by the laboratory under practical and routine laboratory conditions for a variety of sample matrices. Sample-specific reporting limits may vary from the laboratory PQL as a result sample matrix and compound concentration.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

ELEMENTAL ANALYSES - SOLID MATRIX

PARAMETER	METHOD	PQL
Aluminum-ICP	3050/6010	10 mg/kg
Antimony-ICP	3050/6010	20 mg/kg
Arsenic-Furnace AA	3050/7060	0.5 mg/kg
Barium-ICP	3050/6010	0.5 mg/kg
Beryllium-ICP	3050/6010	1.5 mg/kg
Boron-ICP	3050/6010	2.5 mg/kg
Cadmium-ICP	3050/6010	1.0 mg/kg
Calcium-ICP	3050/6010	2.5 mg/kg
Chromium-ICP	3050/6010	1.5 mg/kg
Chromium, Hexavalent-Chelation/Extractio	3060/7197	0.5 mg/kg
Cobalt-ICP	3050/6010	1.5 mg/kg
Copper-ICP	3050/6010	2.5 mg/kg
Iron-ICP	3050/6010	2.5 mg/kg
Lead-ICP	3050/6010	10 mg/kg
Magnesium-ICP	3050/6010	5.0 mg/kg
Manganese-ICP	3050/6010	1.0 mg/kg
Mercury-CVAA	7471	0.1 ug/g
Molybdenum-ICP	3050/6010	2.0 mg/kg
Nickel-ICP	3050/6010	4.0 mg/kg
Potassium-Furnace AA	3050/6010	2.5 mg/kg
Selenium-Furnace AA	3050/7740	0.5 mg/kg
Silver-ICP	3050/6010	1.5 mg/kg
Sodium-ICP	3050/6010	5.0 mg/kg
Thallium-Furnace AA	3050/7841	0.5 mg/kg
Titanium-ICP	3050/6010	10 mg/kg
Vanadium-ICP	3050/6010	2.5 mg/kg
Zinc-ICP	3050/6010	2.5 mg/kg

PQL = Practical Quantitation Limit represents the normally obtainable measurement level achieved by the laboratory under practical and routine laboratory conditions for a variety of sample matrices. Sample-specific reporting limits may vary from the laboratory PQL as a result of sample matrix and compound concentration.

ICP = Inductively Coupled Plasma

AA = Atomic Absorption

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

ANALYTICAL METHOD INFORMATION

PARAMETER: BTEX

METHOD: 8020

MATRIX: Solid

<i>COMPOUND</i>	<i>PQL (ug/kgdrywt)</i>
Toluene	1
Benzene	1
Ethylbenzene	1
Xylenes	2

ANALYTICAL METHOD INFORMATION

PARAMETER: MTBE

METHOD: 8020

MATRIX: Solid

<i>COMPOUND</i>	<i>PQL (ug/drywt)</i>
Methyltertbutyl Ether	2

PQL = Practical Quantitation Limit represents the normally obtainable measurement level achieved by the laboratory under practical and routine laboratory conditions for a variety of sample matrices. Sample-specific reporting limits may vary from the standard PQL as a result of sample matrix and compound concentration.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

ANALYTICAL METHOD INFORMATION

PARAMETER: GASOLINE IN WATER

METHOD: MEDEP-LOP 4.2.1

MATRIX: AQUEOUS

<i>COMPOUND</i>	<i>PQL (mg/L)</i>
Gasoline in Water	0.020

PARAMETER: GASOLINE IN SOIL

METHOD: MEDEP-LOP 4.2.3

MATRIX: SOLID

<i>COMPOUND</i>	<i>PQL (mg/kg drywt)</i>
Gasoline in Soil	5

PARAMETER: FUEL OIL IN WATER

METHOD: MEDEP-LOP 4.1.1

MATRIX: AQUEOUS

<i>COMPOUND</i>	<i>PQL (mg/L)</i>
Fuel Oil in Water	1

PARAMETER: FUEL OIL IN SOIL

METHOD: MEDEP-LOP 4.1.2

MATRIX: SOLID

<i>COMPOUND</i>	<i>PQL (mg/kgdrywt.)</i>
Fuel Oil in Soil	35

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Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

ELEMENTAL ANALYSES - AQUEOUS MATRIX

PARAMETER	METHOD	PQL
Aluminum-ICP	200.7/6010	0.100 mg/L
Antimony-Furnace AA	204.2/7041	0.005 mg/L
Arsenic-Furnace AA	206.2/7060	0.005 mg/L
Barium-ICP	200.7/6010	0.005 mg/L
Beryllium-ICP	200.7/6010	0.015 mg/L
Boron-ICP	200.7/6010	0.025 mg/L
Cadmium-ICP	200.7/6010	0.010 mg/L
Calcium-ICP	200.7/6010	0.025 mg/L
Chromium-ICP	200.7/6010	0.015 mg/L
Chromium, Hexavalent-Colorimetric	7196	0.010 mg/L
Cobalt-ICP	200.7/6010	0.015 mg/L
Copper-ICP	200.7/6010	0.025 mg/L
Gold-ICP	200.7/6010	0.100 mg/L
Iron-ICP	200.7/6010	0.025 mg/L
Lead-ICP	200.7/6010	0.100 mg/L
Lead-Furnace AA	239.2/7421	0.005 mg/L
Magnesium-ICP	200.7/6010	0.050 mg/L
Manganese-ICP	200.7/6010	0.010 mg/L
Mercury-CVAA	245.1/7470	0.20 ug/L
Molybdenum-ICP	200.7/6010	0.020 mg/L
Nickel-ICP	200.7/6010	0.040 mg/L
Platinum-Furnace AA	255.2	0.005 mg/L
Potassium-Flame AA	258.1	0.025 mg/L
Potassium-ICP	200.7/6010	0.500 mg/L
Selenium-Furnace AA	270.2/7740	0.005 mg/L
Silver-ICP	200.7/6010	0.015 mg/L
Sodium-ICP	200.7/6010	0.050 mg/L
Thallium-Furnace AA	279.2/7841	0.005 mg/L
Tin-ICP	200.7/6010	0.100 mg/L
Titanium-ICP	200.7/6010	0.100 mg/L
Vanadium-ICP	200.7/6010	0.025 mg/L
Zinc-ICP	200.7/6010	0.025 mg/L

PQL = Practical Quantitation Limit represents the normally obtainable measurement level achieved by the laboratory under practical routine laboratory conditions for a variety of sample matrices. Sample-specific reporting limits may vary from the laboratory PQL as a result of sample matrix and compound concentration.

ICP = Inductively Coupled Plasma

AA = Atomic Absorption

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

GENERAL CHEMICAL ANALYSES - AQUEOUS MATRIX

PARAMETER	METHOD	PQL
Acidity	305.1	10 mg/L
Alkalinity-Manual Titrimetric	310.1	20 mg/L
Alkalinity-Electrometric Titration	SM 403	20 mg/L
Bicarbonate, Carbonate (see pH & alkalinity)	calc.	mg/L
Biochemical Oxygen Demand-Carbonaceous	405.1	6 mg/L
Biochemical Oxygen Demand-Total	405.1	6 mg/L
Chemical Oxygen Demand-Manual Colorimetric	410.4	15 mg/L
Chloride-Automated Ferricyanide	325.2	2 mg/L
Chlorine, Total Residual	330.5	0.1 mg/L
Coliform, Fecal	APHA 909C	1/100 mL
Coliform, Total	APHA 909A	1/100 mL
Color, True	110.2	5 PTCO
Color, Apparent	110.2	5 PTCO
Corrosivity-NACE Standard TM-01-69	1110	10 mpy
Cyanide, Total-Spectrophotometric	335.2	20 ug/L
Cyanide, Amenable-Spectrophotometric	335.1	20 ug/L
Dissolved Oxygen(Laboratory)-Membrane Electrode	360.1	1 mg/L
Fluoride, Potentiometric ISE	340.2	0.2 mg/L
Fluoride with distillation, Potentiometric ISE	340.1/340.2	0.2 mg/L
Hardness, Total-Manual Titrimetric	130.2	5 mg/L
Ignitability-Flash Point (closed cup)	1010	25 Degrees Celsius
MBAS, Extraction-Colorimetric	425.1	0.04 mg/L
Ammonia-Nitrogen-Automated Phenate	350.1	0.1 mg/L
Organic Nitrogen-Auto. Block Digest., Spectro.	350.1/351.2	0.1 mg/L
Total Kjeldahl Nitrogen-Auto Block Digest, Spect	351.2	0.1 mg/L
Nitrate+Nitrite-Automated Cadmium Reduction	353.2	0.05 mg/L
Nitrate-Automated Cadmium Red./Diazotization	353.2/354.1	0.05 mg/L
Nitrite-Automated Diazotization	354.1	0.05 mg/L
Oil & Grease-Total Recoverable, Gravimetric	413.1	5 mg/L
Oil & Grease-Total Recoverable, Infrared	413.2	1.5 mg/L
Oil & Grease-Hydrocarbons, Grav./Solvent Extract	APHA 503E	5 mg/L
pH (Laboratory)	150.1	---
Phenolics, Total Recoverable-Manual 4AAP	420.1	5 ug/L
Phosphate, Total-Auto Ascorbic Acid/Block Digestion	365.4	0.1 mg/L
Phosphate, Ortho-Auto. Ascorbic Acid	365.1	0.05 mg/L
Silica-Manual Molybdosilicate	370.1	1 mg/L
Solids-Nonfilterable Residue (TSS)	160.2	4 mg/L

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Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

GENERAL CHEMICAL ANALYSES - AQUEOUS MATRIX

PARAMETER	METHOD	PQL
Solids-Volatile Nonfilterable Residue (VSS)	160.2/160.4	10 mg/L
Solids-Filterable Residue (TDS), Gravimetric 180	160.1	10 mg/L
Solids-Volatile Filterable Residue (VDS)	160.1/160.4	10 mg/L
Solids-Settleable Solids (SS)	160.5	0.2 mL/L
Solids-Total Solids	160.3	10 mg/L
Specific Conductance-Wheatstone Bridge	120.1	umhos/cm
Sulfate-Turbidimetric	375.4	1 mg/L
Sulfite-Titrimetric	377.1	3 mg/L
Sulfide-Iodometric	376.1	1 mg/L
Sulfide-Monier-Williams	40CFR-425	0.5 mg/L
Sulfide-Reactive	7.3.4.1	
Tannin/Lignin-Colorimetric	APHA 513	1 mg/L
Total Organic Carbon-Oxidation	415.1	1 mg/L
Total Inorganic Carbon	415.1	1 mg/L
Total Organic Halogen	9020	mg/L
Total Petroleum Hydrocarbons-Extraction, IR	418.1	1 mg/L
Turbidity	180.1	1 NTU

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Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

ANALYTICAL METHOD INFORMATION

PARAMETER: BTEX

METHOD: 602

MATRIX: AQUEOUS

<i>COMPOUND</i>	<i>PQL (ug/L)</i>
Toluene	1
Benzene	1
Ethylbenzene	1
Xylenes	2

ANALYTICAL METHOD INFORMATION

PARAMETER: MTBE

METHOD: 602

MATRIX: AQUEOUS

<i>COMPOUND</i>	<i>PQL (ug/L)</i>
Methyltertbutyl Ether	2

PQL = Practical Quantitation Limit represents the normally obtainable measurement level achieved by the laboratory under practical and routine laboratory conditions for a variety of sample matrices. Sample-specific reporting limits may vary from the standard PQL as a result of sample matrix and compound concentration.

Coast-To-Coast Analytical Services, Inc.
Northeastern Division
Westbrook, Maine

METHOD REFERENCES

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"Reference Method for the Determination of Particulate Matter as TSP in the Atmosphere", 40CFR Part 50 Appendix B.

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Other

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"Official Methods of Analysis of the Association of Official Analytical Chemists", Methods Manual, 14th ed., 1985.

"Annual Book of ASTM Standards, Volume II (D-19 Water), American Society for Testing and Materials, 1988"

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(water 4.2.1)
(water 4.1.1)

SAMPLE CHAIN OF CUSTODY

Project # 98-65		Project Name Brunswick NAS				Number of Containers	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">BTEX+MTBE EPA 8020</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TOTAL LEAD EPA 742.1</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">GASOLINE ME DEP 4.2.3</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">FUEL OIL ME DEP 4.1.2</div> <div style="writing-mode: vertical-rl; transform: rotate(180deg);">TPH EPA 418.1</div> </div>					Airbill #
Sampler CD		ERM Contact Rob Stockwell					Remarks					
ERM Traffic Report	Date 1992	Time	Comp or Grab (C or G)	Sample Matrix	Station Location							
	5/14	11:00	G	Soil	MW-1, 9-10.5'	5	X	X	X	X	X	98-65-01
	5/14	2800	G	Soil	MW-4, 7-8.5'	5	X	X	X	X	X	98-65-04
	5/15	9:00	G	Soil	*MW-2, 7-8.5'	5	X	X	X	X	X	98-65-02
	5/15	-	G	Water	Trip Blank	2	X					98-65-14 (from lab)
	5/15	9:00	G	Water	Source Water	8	X	X	X	X	X	98-65-06
	5/15	11:00	G	Soil	MW-3, 7-9'	5	X	X	X	X	X	98-65-03
	5/15	1:00	G	Water	Equipment Blank	3	X				X	98-65-13
	5/15	3:00	G	Soil	MW-5, 4-6'	5	X	X	X	X	X	98-65-05
Sample Relinquished by			Sample Received by			Date	Time		Reason for Transfer			
Charles J. Leger			Robert Stockwell			5/15/92			TO LAB			
			Dorothy D. Pellechia			05/16/92	9:45					